

NLEAP Client/server Tools for Estimating $\text{NO}_3\text{-N}$ Leaching and N_2O Emissions

Tutorial Lessons



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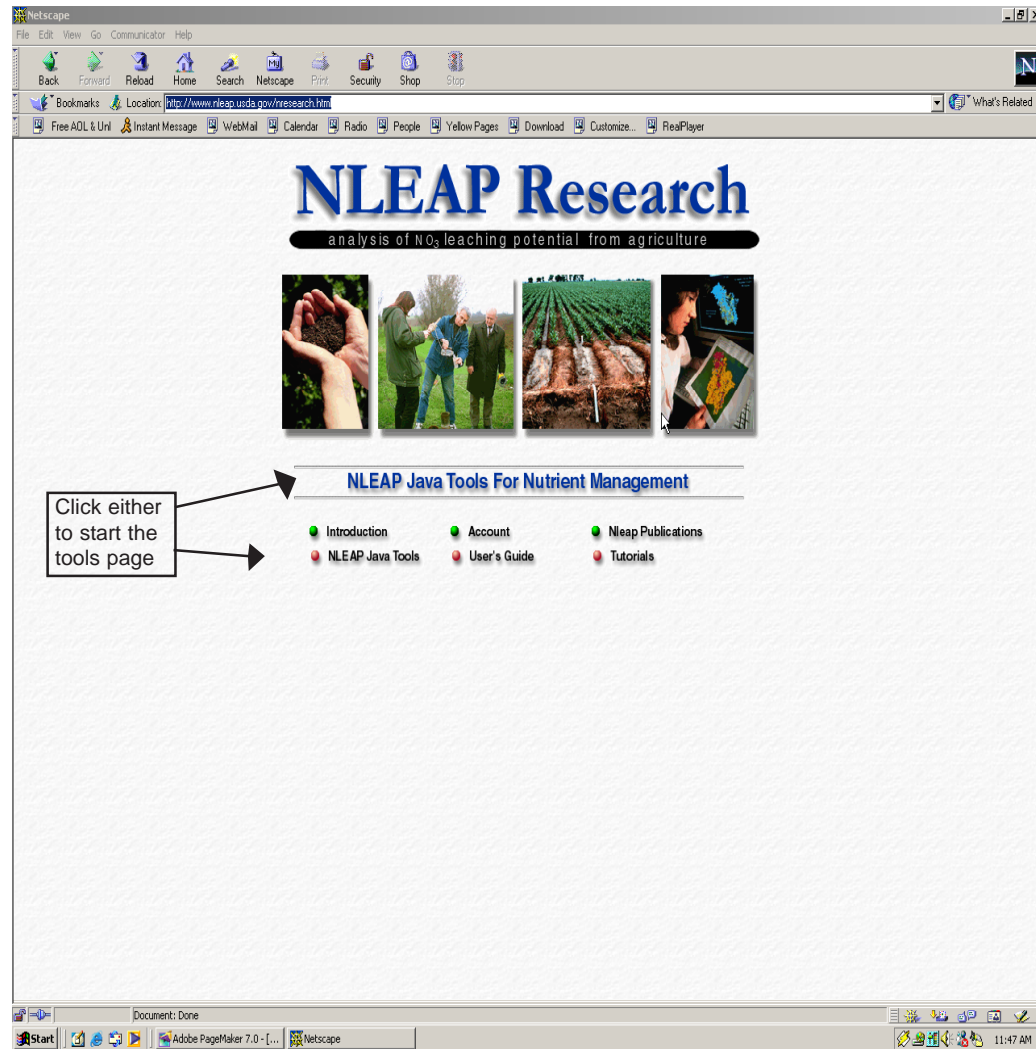


Figure 1, NLEAP Main Web Page

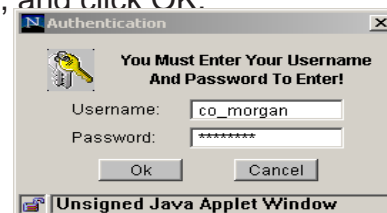
Welcome to the Internet NLEAP (Nitrate Leaching and Environmental Analysis Package) tutorial!

What is Internet NLEAP?

The NLEAP model has been extended for direct use on the Internet or locally with an intranet, and now estimates both $\text{NO}_3\text{-N}$ leaching and N_2O emissions from agricultural lands. $\text{NO}_3\text{-N}$ leaching has raised both health and environmental concerns, and soil N_2O emissions to the atmosphere have implications in global climate change. With this system, you will input your farm field boundaries and management practices, follow the steps listed, and get estimated $\text{NO}_3\text{-N}$ leaching and N_2O emission values on your farm. Sound nutrient management practices can then be identified that maintain or improve production and reduce environmental risks from $\text{NO}_3\text{-N}$ leaching and N_2O soil emissions.

Establishing an Account.

Before using the NLEAP model, users must establish an individual account. To establish an account, contact your system administrator or see instructions for a local installation. You will be asked which counties your farm resides in, so please have this information available. You will then be assigned an account log-in and password. To log-in to the system, navigate to the NLEAP Web page at <http://www.nleap.usda.gov/nresearch.html> (note: this URL may be assigned to a local intranet IP address). Place your cursor over the “NLEAP Java Tools” listing, and click your mouse. The username and password box are displayed after click was assigned to you, along with your password, and click OK.



NLEAP Java Tools For Nutrient Management

● Introduction

● NLEAP Java Tools

● Account

● User's Guide

● Nleap Publications

● Tutorials

NLEAP Publications (compiled May 1999)

Shaffer, M.J., A.D. Halvorson, and F.J. Pierce. 1991.
Nitrate leaching and economic analysis package (NLEAP): Model description and application. Chapter 13, pp. 285-322 In R.F. Follett, et al. (Eds.) Managing Nitrogen for Groundwater Quality and Farm Profitability. Soil Science Society of America, Inc., Madison, WI, 357 pp.

Pierce, F.J., M.J. Shaffer, and A.D. Halvorson. 1991.
Screening procedure for estimating potentially leachable nitrate-nitrogen below the root zone. Chapter 12, pp. 259-283. In R.F. Follett, et al. (Eds.) Managing Nitrogen for Groundwater Quality and Farm Profitability. Soil Science Society of America, Inc., Madison, WI, 357 pp.

NLEAP streaming video tutorial:

[GIS Server - Introduction](#)

[NLEAP Simulation Server](#)

[Climate Download Tool](#)

[Graphics tool](#)

[Detailed Management - Introduction](#)

[Detailed Management - Advanced](#)

[MUIR Soils Download Tool](#)

[GIS Soils-Management Tool](#)

[Quick Management Wizard](#)

[Quick Soils Wizard](#)

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graph TD; subgraph Tools [NLEAP Java Tools For Nutrient Management]; direction TB; I[● Introduction]; NJT[● NLEAP Java Tools]; A[● Account]; UG[● User's Guide]; NP[● Nleap Publications]; T[● Tutorials]; end; NP --> NP_Link[NLEAP Publications (compiled May 1999)]; T --> T_List[GIS Server - Introduction, NLEAP Simulation Server, Climate Download Tool, Graphics tool, Detailed Management - Introduction, Detailed Management - Advanced, MUIR Soils Download Tool, GIS Soils-Management Tool, Quick Management Wizard, Quick Soils Wizard];
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Figure 2, Tutorial and NLEAP Publications buttons

NLEAP Main Webpage Details

The Tutorials button provides access to a suite of streaming video clips that give an overview and details of Client/server NLEAP. The videos discuss various aspects of the NLEAP applet toolkit such as GIS techniques, downloading of soil and climate data, selecting and refining management scenarios, making simulation runs, and analyzing output. The user is encouraged to view these clips both as an introduction to Internet NLEAP and as a resource for more detailed user information.

The NLEAP publications list provides a fairly comprehensive reference source for work published by various authors who have developed, tested, and/or applied the NLEAP model since the early 1990's. Model details, examples of model applications, model testing results, and model databases can be found in publications on this list.

The User's guide button initiates an on-line Adobe Acrobat version of this user's manual.

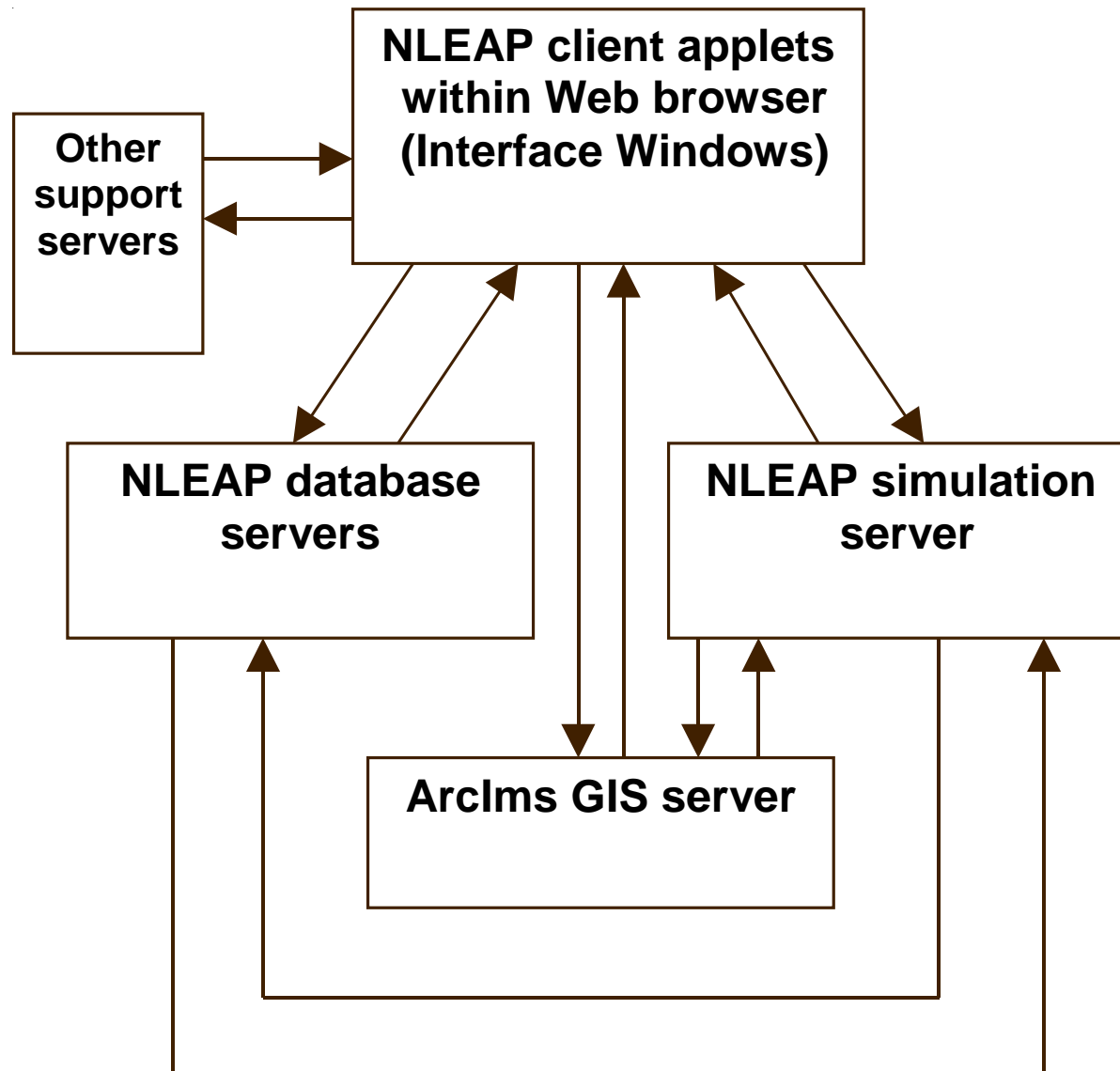


Figure 3, NLEAP Client-Server Configuration.

Introduction to NLEAP Client-Server System

The general configuration of the NLEAP client-server system for use on the Internet, a local intranet, or offline with Microsoft XP equipped with Internet Information Server (IIS) and a browser is shown in Figure 2. The Java-applet interface windows for use in the Microsoft Internet Explorer (IE) Web browser provide access to the NLEAP model server, the individual user account files on the NLEAP Web server, the NRCS soil and climate database servers, and the NLEAP ArcIms GIS server. The majority of the data flow occurs directly between the servers and the databases with the user interface acting as a control and display device. The user's account also contains configuration files allowing for customization of individual applet menu lists and the crop parameter file for multiple crops. The NLEAP client-server system was designed to minimize upload and download times and conserve usage of bandwidth over the network. Applet sizes have been kept small (75 kbytes to 1.5 mbytes) and data transfers between the client and servers have been limited to operational commands, minimal data uploads, and data downloads for summaries of graphical, GIS mapping, and tabular output. The vast majority of the computational work is performed by the servers.

Simulation Server

The simulation server uses existing NLEAP technology developed for the NLEAP DOS versions and programming from the object-oriented framework of the Great Plains Framework for Agricultural Resource Management (GPFARM) Decision Support System (DSS) for farms and ranches. The server consists of Formula Translation (FORTRAN) language soil-process modules adapted and extended from NLEAP DOS versions 1.2 and 1.3 and is linked directly to an object-oriented C++ computer-language framework adapted from GPFARM. Processes simulated include infiltration and transport of soil water and nitrates; carbon and nitrogen cycling and transformations on the soil surface and within the soil profile; surface runoff of water, nitrate and ammonium; nitrate leaching from the root zone; crop uptake of nitrate and ammonium; denitrification losses (including N_2 and N_2O); and ammonia volatilization. Additional technical details are described in Shaffer et al.(2001), Ma and Shaffer (2001), and Xu et al.(1998). The simulation server is designed to run multiple years of management and climate scenario data at the option of the user. A linkage is maintained with the GIS server through the field and soil mapping unit (MU) identification codes.

GIS Server

The GIS server is based on a customized version of Environmental Systems Research Institute (ESRI) ArcIms 3.0 that allows the user to draw field boundaries and then intersect these boundaries with the NRCS Soil Survey Geographic (SSURGO) soil survey map layer for the site. A list of soil mapping units (MU's) within each field is then passed to the NLEAP interface for processing. The user next associates an appropriate management scenario with each soil in the field and calls the NLEAP server. The NLEAP model places results for the last year of the simulation along with other optional parameters for each soil in the field into a MS Access output database table (see Graphics server discussion above for list). The GIS interface contains a control button that tells the GIS server to join the new results in the output table to the existing GIS soil attribute table. Model input variables and simulated results are then available for display on the GIS map of the field. The ArcIms interface allows display of the soil attributes as individual results or mapped as user specified ranges across the field. Maps can be printed to the user's local printer or saved as a data layer on the user's computer.

Database Servers

Using C++ server programs and FTP file transfers, servers were developed to automatically connect with NRCS soil and climate databases, download user selected data subsets, convert these subsets to NLEAP format, and store the results into the proper database tables on the user's account.

Soils Databases

The NRCS National Soil Information System (NASIS) is the platform that NLEAP will eventually address to access soil related data. NRCS is in the process of developing the interface for computer simulation models to access NASIS data and download needed information. In the interim, NLEAP is using the older NASIS predecessor, the Map Unit Interpretation Record (MUIR). A JAVA interface applet allows the user to select the required MUIR data set from the national list. These data are then automatically downloaded to the server and converted to NLEAP format using a C++ program. The same program also clears the data set of partial records and calculates missing values for Cation Exchange Capacity (CEC) and soil water content at 15 bars before writing to the soils database table.

Climate Database

The NRCS National Water and Climate Center (NWCC) is the clearinghouse for climatic information within USDA. NWCC in cooperation with the Unified Climate Access Network (UCAN), a joint project of a number of agencies with the primary architects, the NRCS and Regional Climate Centers, has developed a Web interface to retrieve climate data for a variety of uses. The current version of NLEAP will use the data derived from UCAN. Ultimately NLEAP will be interfaced with UCAN to provide the required climatic information. In addition the NWCC is currently working on a project that will provide the basic evapotranspiration information required in most process models to describe water extraction from the soil by plants. These calculated values will improve the estimates provided by process models for runoff, soil loss and environmental impacts such as nitrate leaching as provided in the NLEAP model.

Currently, NLEAP interacts with the NWCC Climatic Database, allowing the user to access historic and real time climatic data records from a choice of nearby weather stations through the NWCC ftp site (<ftp://ftp.wcc.nrcs.usda.gov/support/climate/daily-data>). Temperature and precipitation data are readily available from this Web site; however, potential evaporation data must be obtained by other means. Work is still on- going to develop options for daily evaporation data for NLEAP.

Meanwhile, users must either supply their own potential evaporation data or allow the climate interface to calculate daily potential evaporation from extraterrestrial radiation and air temperature, based on a method developed by Hargreaves and Samani (????).

An interface applet provides the user with a list of available climate stations for each State. The selected climate database file is then downloaded to the server where a C++ program removes data years containing incomplete or missing records, converts the data to NLEAP format, optionally calculates potential evaporation, and writes the resulting climate records to an NLEAP climate database table chosen by the user.

NLEAP and GIS (Geographic Information System) technology

OVERVIEW OF GIS PROCESSES IN NLEAP

NLEAP now includes a GIS component for more accurate use of local soils data and better presentation of results for analysis. The application uses ESRI's internet map serving tool, ArcIMS, for GIS map drawing and viewing. ArcIMS includes a server component for serving map layers on a web server and Java client plug-in components for viewing and editing these map layers in a web browser. This allows local county map layers to be served and viewed on the browser, farm field boundaries to be drawn on these maps, and NLEAP results to be viewed. The application also contains Visual Basic programs using ESRI's MapObjects components, which merge and convert the GIS data into table formats that can be utilized by the NLEAP model software. These programs also generate new map layers containing soils and results data that can be viewed as a map for analysis.

FARM DRAWING TOOLS

NLEAP provides GIS tools for drawing an accurate boundary of the farm fields to be modeled. These are provided through ESRI's ArcIMS software. Local county GIS data (roads, streams, soils, etc.) are served via ArcIMS's server component and are viewed by the Java client component on a web browser. Various tools are provided for the users to locate and view a farm area. These include the zoom in/out and pan tools for navigation, search and identify tools, and labeling tools.



Navigation Tools

The viewing screen has editing tools for drawing accurate farm field boundaries on top of this county data. The tools provide for drawing standard shapes (squares, rectangles, circles) or irregular polygons, thus allowing for a variety of farm bound-



Drawing Tools

PROCESSING GIS DATA

The GIS data is processed into a format for use by the NLEAP modeling software in several steps. These use a combination of ArcIMS software processes and Visual Basic programs utilizing ESRI's MapObjects. The GIS processing steps can be divided into two groups: The Submit Field process and the Join Results process.



Submit and Join Results Buttons

Submit Field Process

Create Shape File- A Visual Basic program converts the farm boundary points created in the previous step into a temporary shapefile. MapObjects components are used for this process.

Clip Soils Data to Farm Boundary- The SSURGO soils data is clipped to the farm boundary using a Visual Basic/MapObjects program. The output is a temporary shapefile with soils boundaries for the farm only.

Join Shape Data With MUIR Data- A Visual Basic/MapObjects program performs a join of the farm soils shapefile with MUIR attribute soils data. The program produces a shapefile with this joined data and a tabular file containing soils information to be used by the NLEAP model program.

Serve Join Map to Mapserver- Java scripts run several ArcIMS functions to add the farm/soils shapefile to the mapserver for viewing of soils attributes of the farm. This farm/soils map can be viewed from the browser on top of county data and can be classified/symbolized by any soils category.

JOIN RESULTS PROCESS

Join Farm Soils With Results- After the NLEAP model is run, a Visual Basic/MapObjects program joins the farm soils shapefile with the NLEAP model results (NO3-Leach, NO3-Residual values for each soil unit). The program produces a shapefile with this joined results data as well as soils attribute data.

Serve Results Map to Server- Java scripts run several ArcIMS functions to add the farm/results shapefile to the mapserver. This final results map can be viewed from the browser on top of county data and can be classified/symbolized by any soils or results category.

VIEWING/CLASSIFYING DATA

The ArcIMS client also provides tools for labeling features on the farm soils/results map. Labels can be provided by any soils/results category and fonts and position can be changed for best viewing. Tools for printing the current map or saving to images such as Jpeg are also included. In addition, The user can save the current view and classifications to a project file for later retrieval without the need to open served maps and classify them again.

After field soils data and field results data are generated and served they can be added to the county maps via the client browser tool for viewing. Once added, the ArcIMS client browser provides tools for classifying these field maps based on any soils category such as pH, Organic matter, texture, or any model results category such as NO_3 -Leach or NO_3 -Residual. Unique or graduated classifications can be used and separated by different colors or symbols.

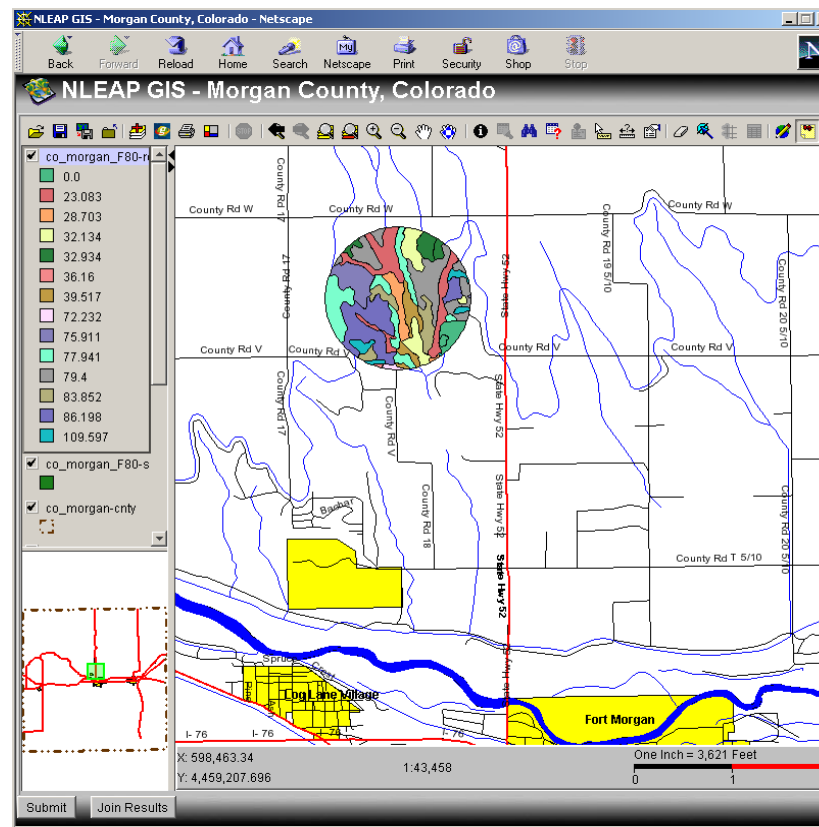


Figure 4, Nitrate Leaching Model

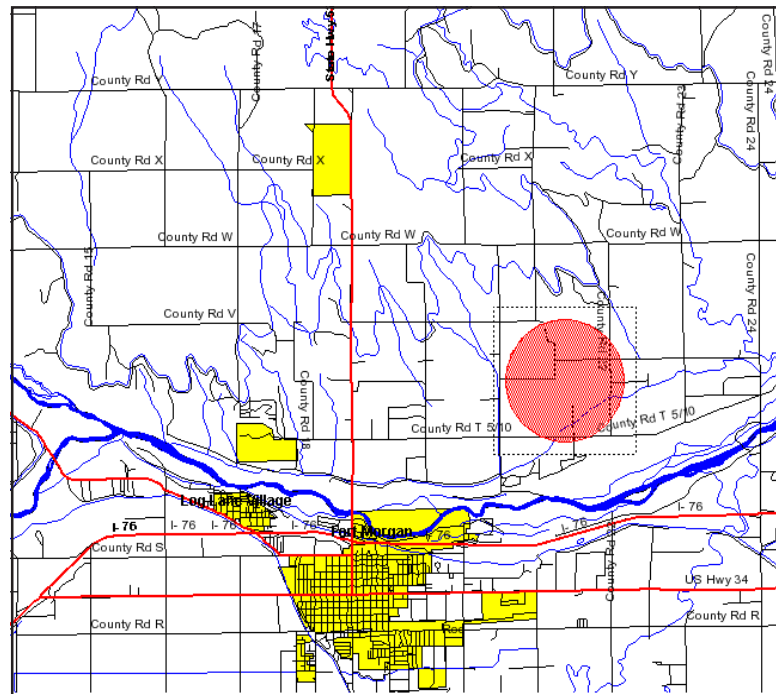


Figure 5, Map of Morgan County, Colorado

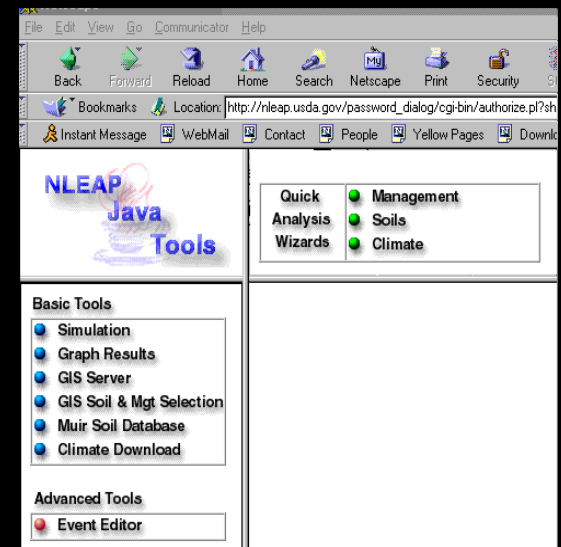
GIS Server- An Introduction

This section serves as an introduction to the Geographic Information System (GIS) component of NLEAP. This provides for more accurate use of local soils data and better presentation and analysis of results. The application uses ESRI's internet map serving tool, ARCIIMS, for GIS map drawing and viewing. ArcIMS allows you to edit a map layer from your web browser, and also to draw your farm boundary on the map. A linkage mechanism allows you to assign soil or other management units identified on the GIS map of a farm to management and climate data scenarios stored on your account. Map layers specific to your account can be displayed for base location maps, soils and soil layer data, selected management, and nitrate leaching results from the NLEAP model. You can also add field and management unit boundaries onto the base map and use these to help direct and display the simulation analyses. The GIS tool is designed to allow management by soil type across a farm, sub-farm, or field.

You will learn:

- *How ArcIMS and GIS work
- *How to zoom to show more map details and load the roads map layer
- *How to label your roads
- *How to pan to your field location
- *How to use the Map Note and Layer buttons
- *How to use the drawing tools
- *How to draw your farm boundary
- *How to submit and join your soils data to your farm boundary
- *How to view your results

Click for video ----->>>



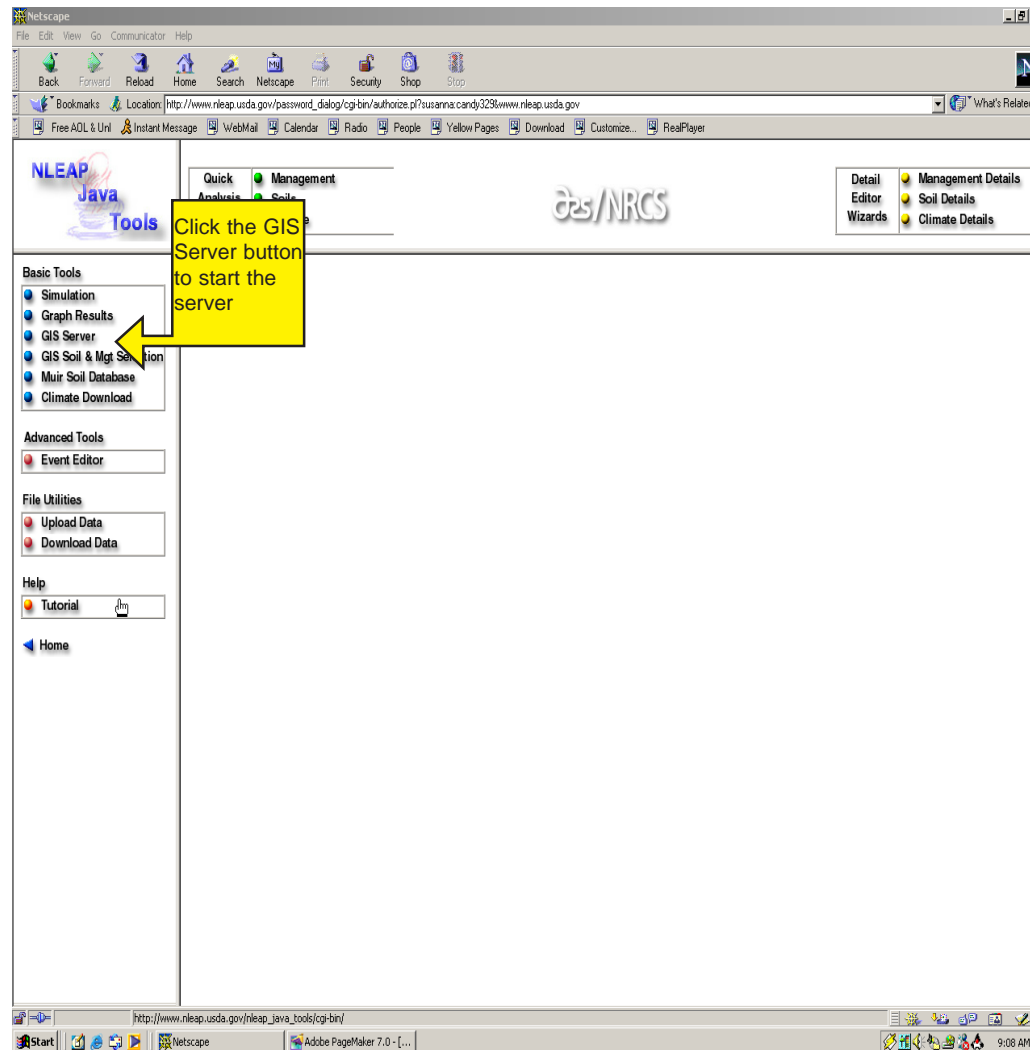


Figure 6, Java Tools Page

You are now logged onto the NLEAP tools area!



To start the ArcIMS GIS program, you will need to place your cursor over the *GIS Server* option under the *Basic Tools* menu and click your mouse.

GIS and ArcIMS

This custom GIS package (ESRI, ArcIMS) can be run from the NLEAP interface via a custom map server, and provides for spatial visualization and mapping of farms and fields. This tool has been interfaced with the rest of the NLEAP Java package and they work together as a unit. For example, a digitized soil map layer can be sub-sampled as a farm field and the intersecting soil mapping units linked to the NLEAP management and climate databases. When the simulation is run, you can choose to run this set of multiple scenarios and have the results (e.g. $\text{NO}_3\text{-N}$ leached, soil residual N, N_2O emissions, etc.) displayed on the GIS map as a data layer. Other information can also be displayed on the map, including roads and towns, field boundaries, soil properties, and management scenarios.

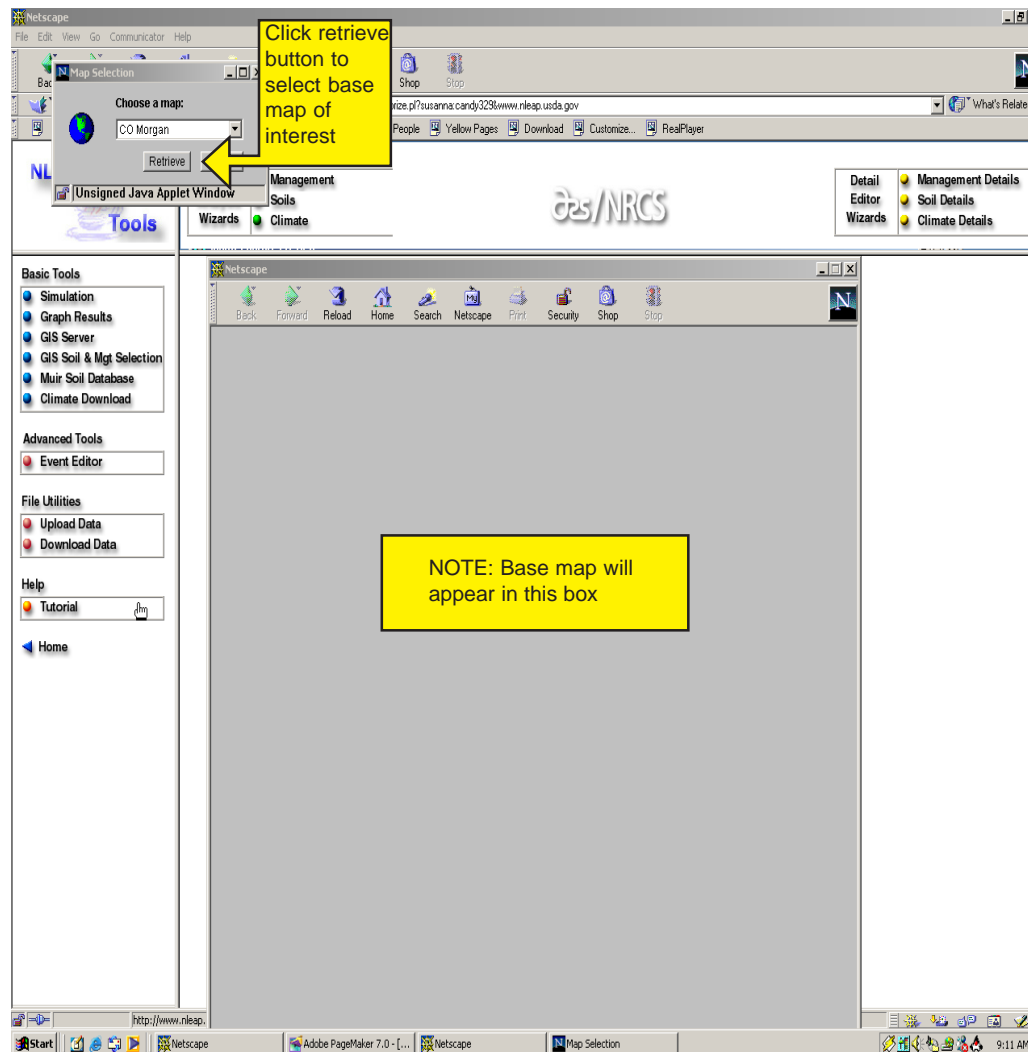


Figure 7, Retrieving a base map

Retrieving a Map

A *Map Selection* window will appear after clicking the *GIS server* button. Under the *Choose A Map* option, select the country you need from the drop-down menu, and then click the *retrieve* button. These maps are pre-loaded by the site administration.

We will be using the Colorado, Morgan County map, *co_morgan*, for this exercise.

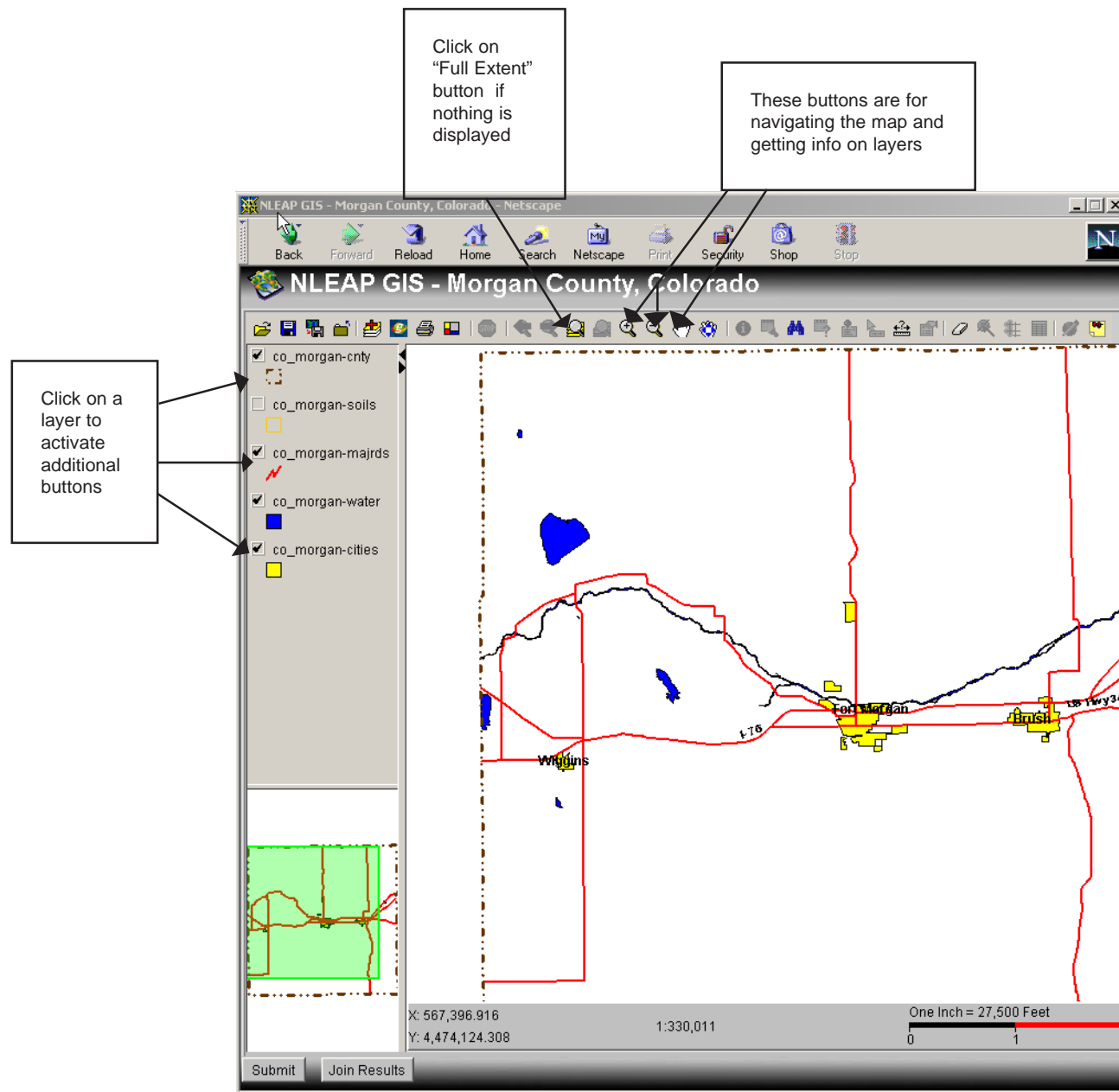


Figure 8, Map layers

Learning About Layers

This is the initial window displayed using Morgan County as an example.

If nothing is displayed on the screen, click on the full extent button .

What is a layer?

A layer is a component of a map. For example, *co_morgan-water* is a map layer representing all of the hydrology in Morgan county. *Co_morgan-majorrds* is the map layer representing all major roads in Morgan County. All map layers may be displayed one at a time or all at once. To display a layer, place your cursor over the box next to the layer name and click. A black checkmark will appear in the box, and the layer will be displayed on the screen. To activate a particular layer, place the cursor on the layer name and click. Active layers are drawn on top of each other using the order from bottom up, as shown on the screen. The display order can be changed by dragging a layer name and moving it up or down. Clicking on a layer will also activate additional buttons.

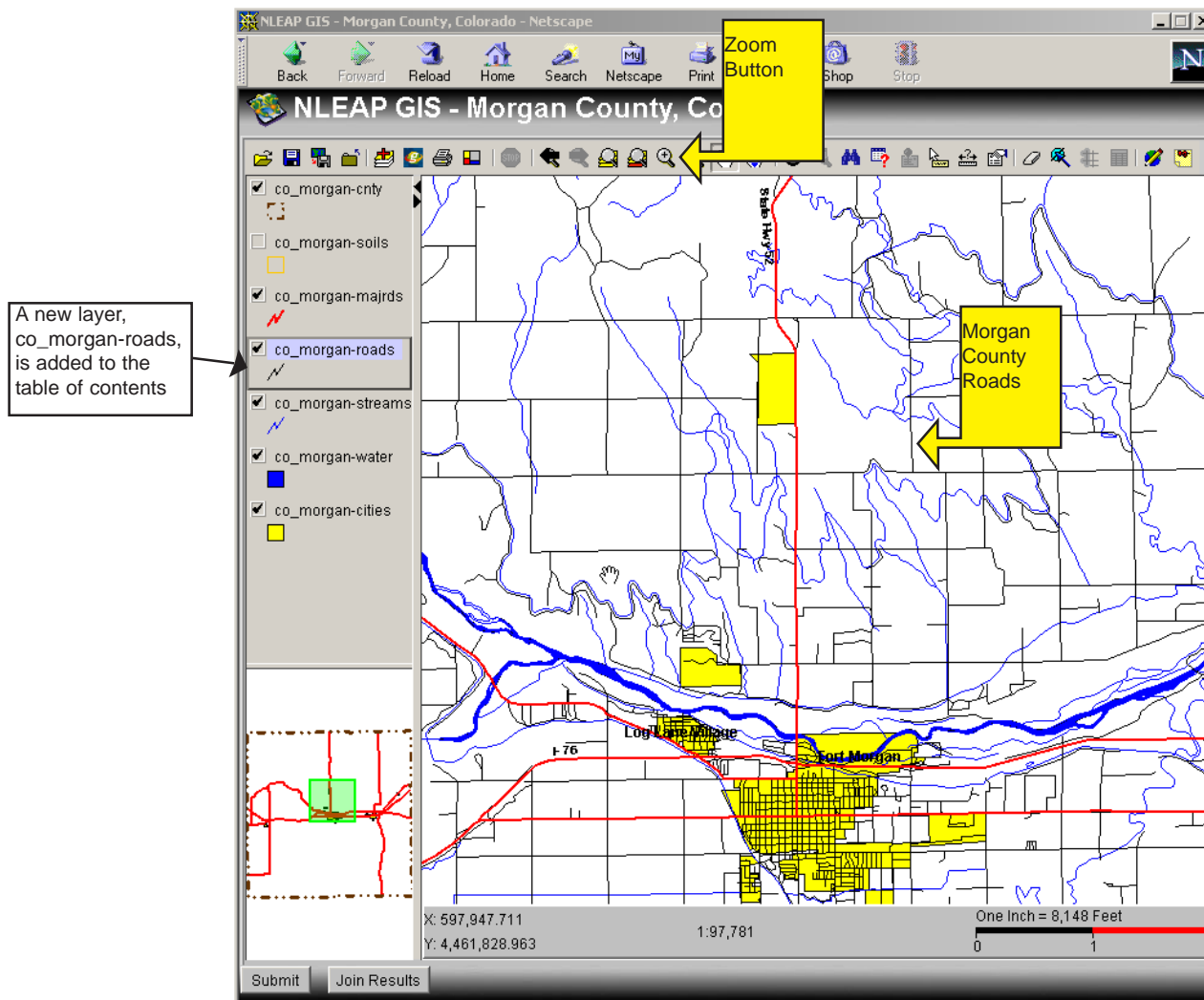



Figure 9, Zoom Button

Zooming In

You will now zoom in to the area where your farm is located. Place your cursor on the zoom button  and click. Next, place your cursor in the area of the map you will enlarge, and click. You will notice more detail in the map as you zoom in. Click several times until you see Morgan County roads, displayed as black lines on your map. This will bring up a new layer on your map, which will be added to the table of contents left of the map. Additional layers, such as Morgan County roads, are displayed at the 1:100,000 scale.

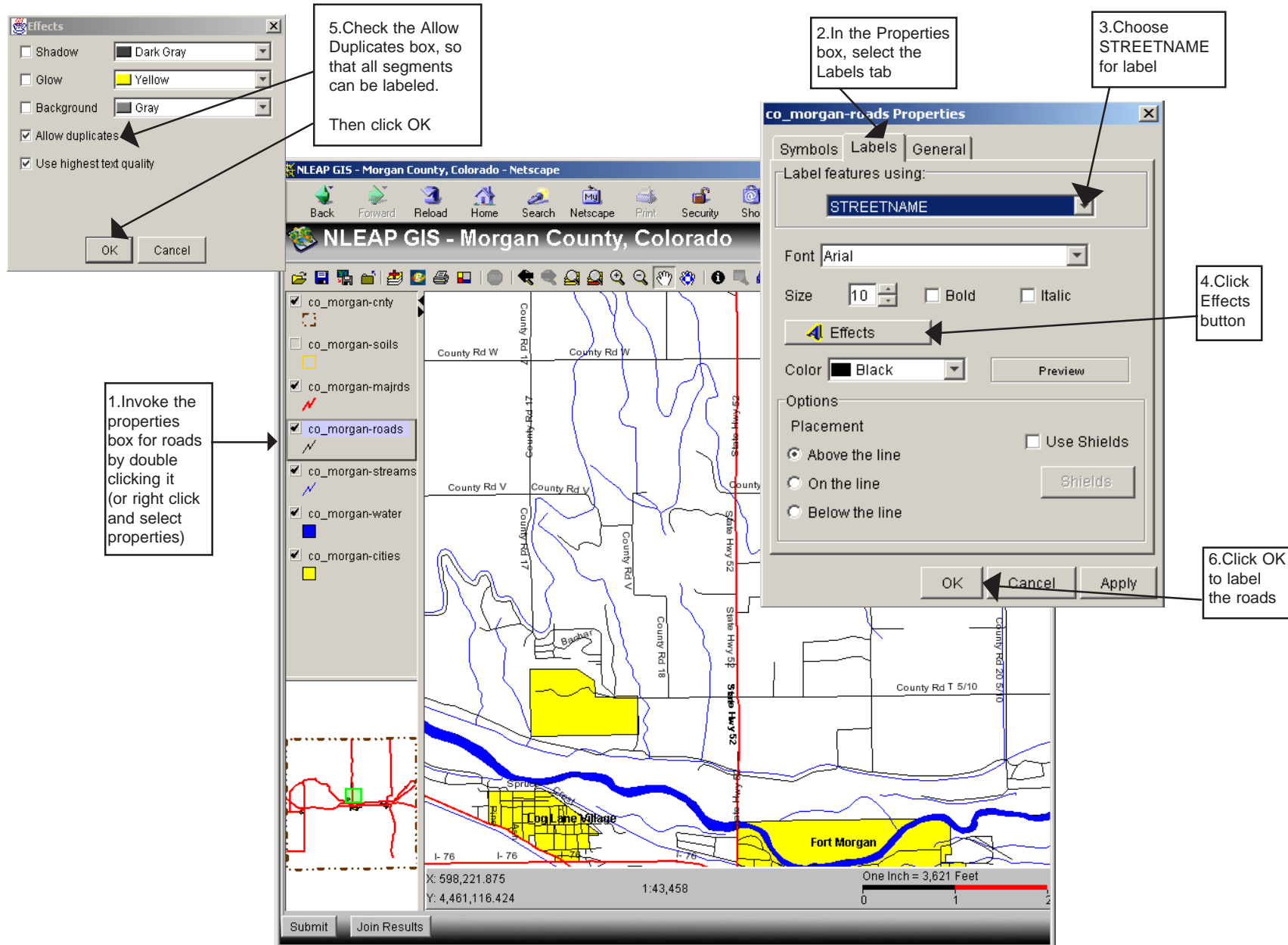


Figure 10, Labels

Labeling Roads

In order to get oriented, you will label the Morgan County roads. Place your cursor over *co_morgan-roads* in the left hand table of contents. Double-click, and a *co_morgan-roads Properties* box will appear. Click on the *Labels* tab. In the *Label Features using* drop-down menu, select STREETNAME. Click the *Effects* button, and an *Effects* box will appear.

Click on the *Allow Duplicates* box, and a black checkmark will appear. Click OK, and then click OK in the *co_morgan-roads Properties* box. Your roads should now be labeled.

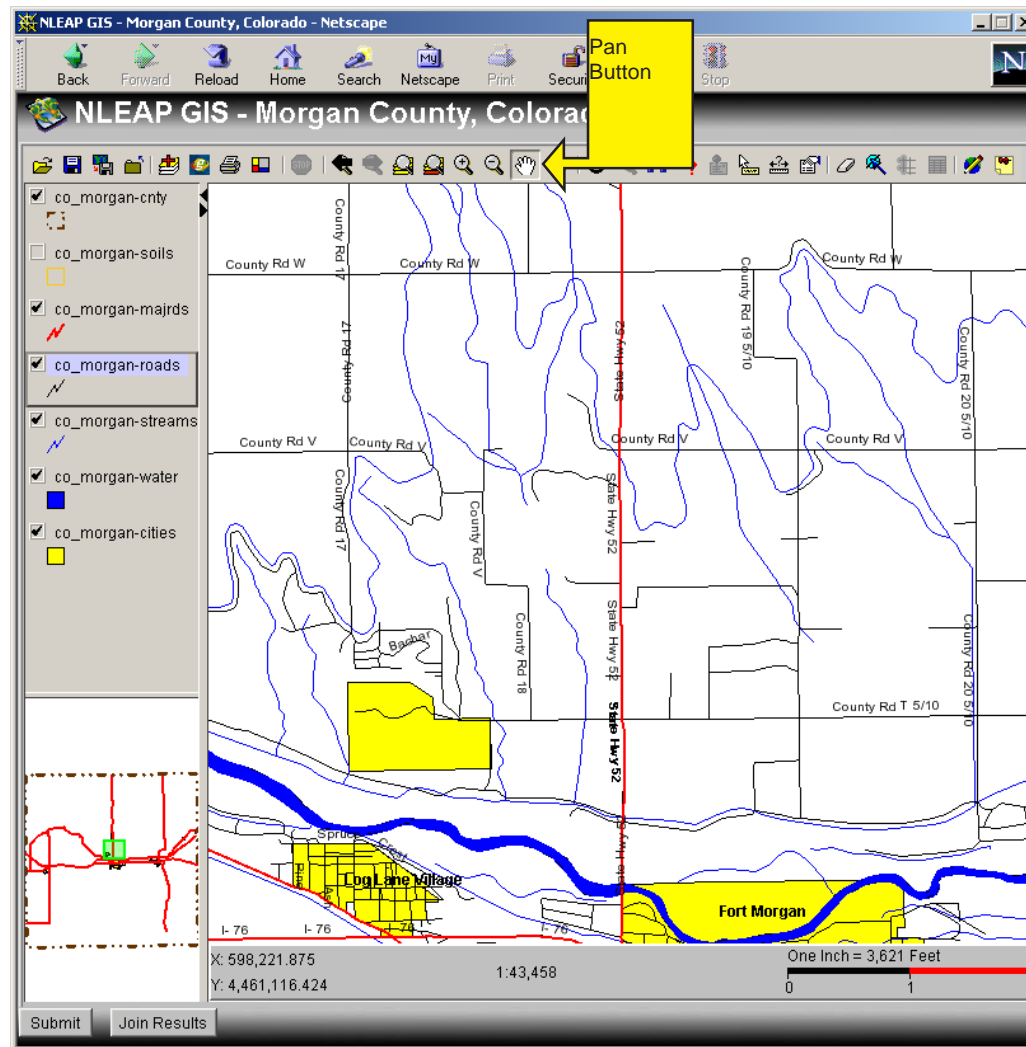



Figure 11, Pan button

Panning to Your Field Location

The road labeled map is displayed to identify the location of your farm. Use the pan button  to move the map to the correct location of your farm. The pan button preserves the scale of the map, and moves the map to a particular area of interest. After you click on the pan button, the hand will be visible on the map. Click the mouse, hold down, and drag the cursor in the desired direction. When the area of interest is in view, let go of the mouse, and the screen will display the area you want.

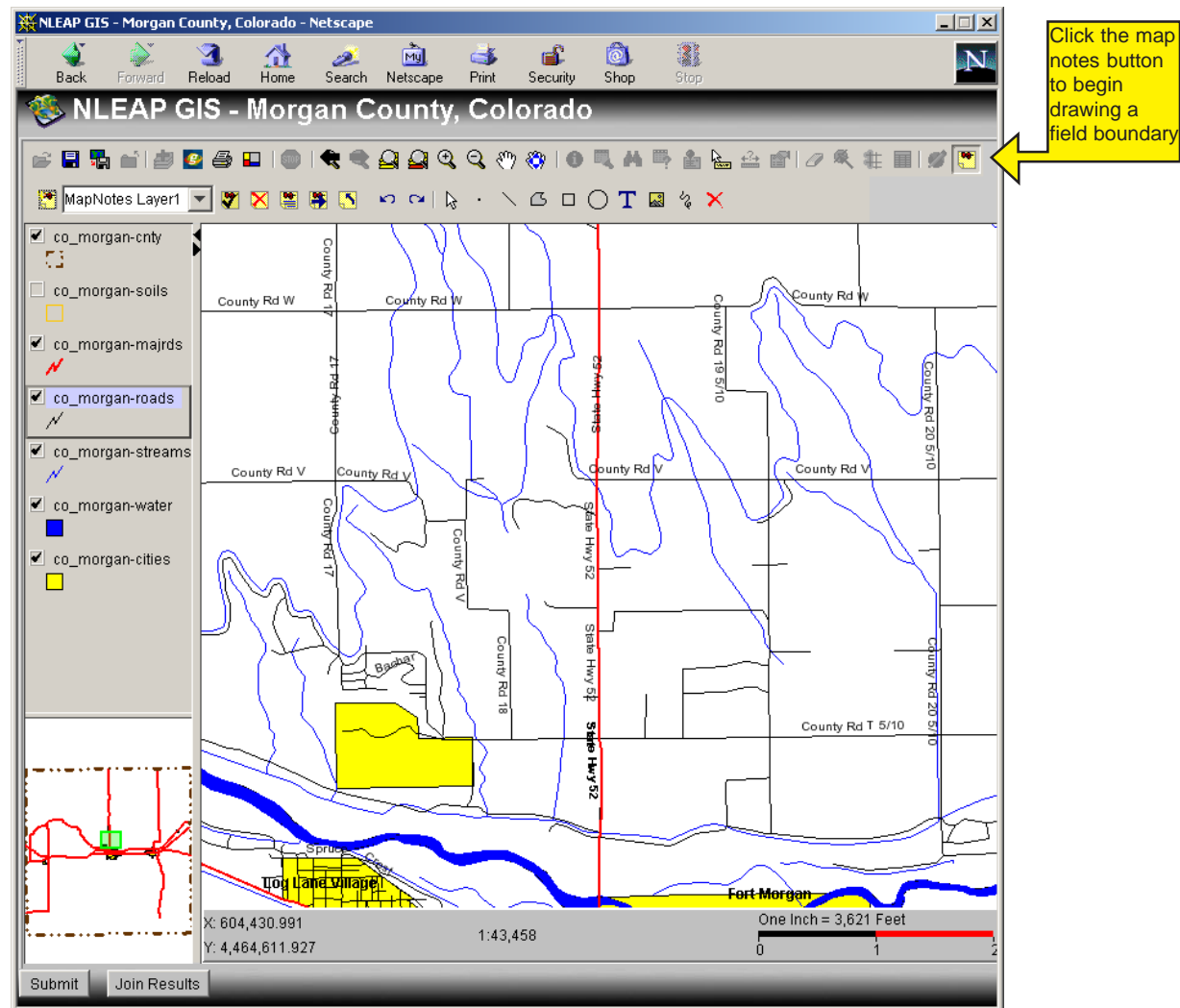


Figure 12, Map Notes Button

Drawing Your Field Boundaries

Click the map notes button  to begin drawing a field boundary.

This button allows you to draw on the base map at different scales of resolution.

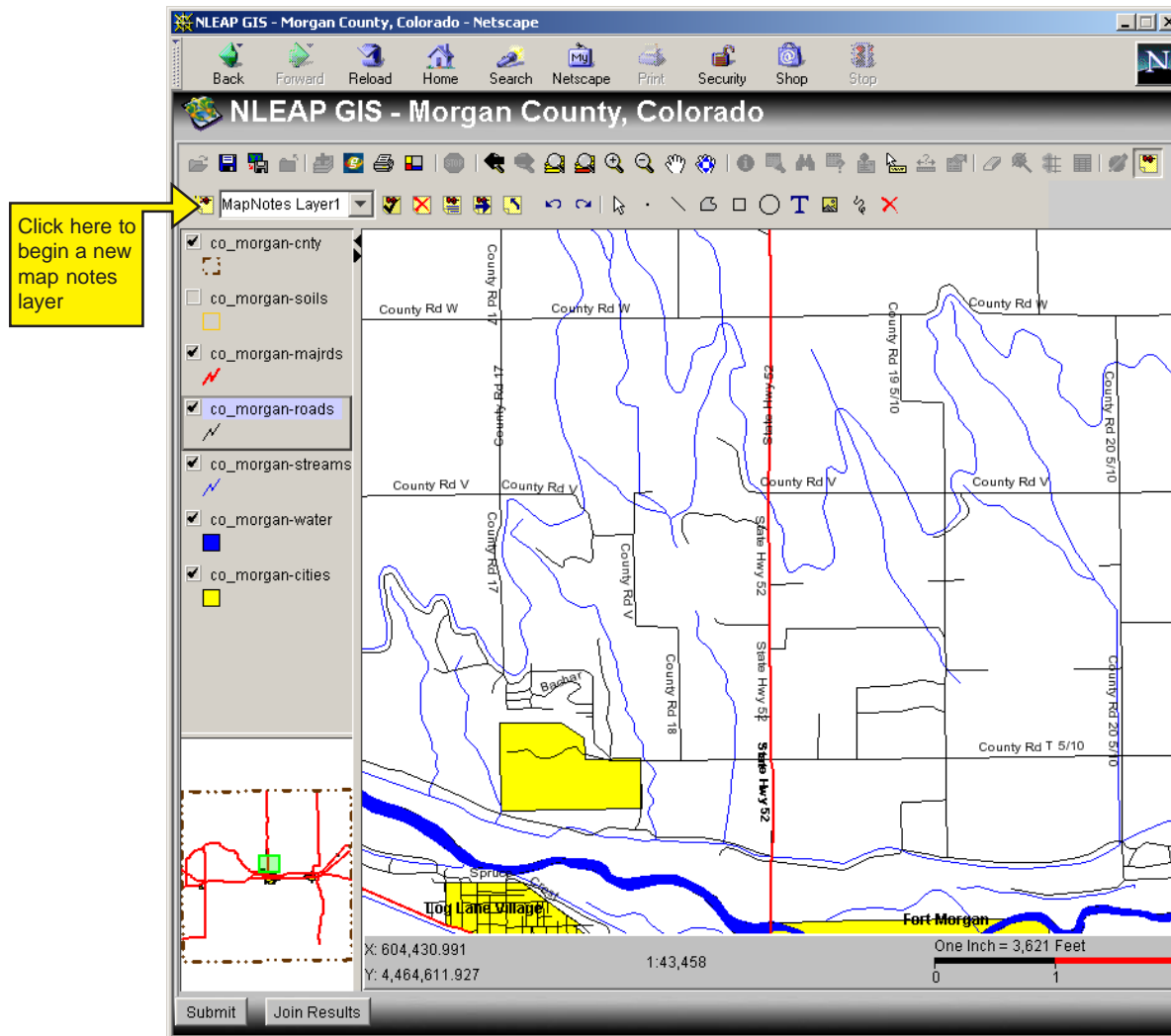






Figure 13, Layer button

Layer Button

Click on the layer button  to begin a new map notes layer.

This button allows for a new map layer to be created by you. The map already had the major roads, Morgan County roads, soils, water, and cities layers for Morgan County. This new layer will be your farm field boundary. Multiple fields can be drawn, but they should be placed in separate layers or limited to two or three fields.

When you click on the map notes layer button, the name box will be displayed with the title Mapnotes Layer1  MapNotes Layer1 . You will need to change the name in this box to your username, which in this case is co_morgan. Place your cursor in the box and delete the current title. Type in your username. The name box should look similar to this:  co_morgan 

You can then click outside the box, and continue with the exercise.

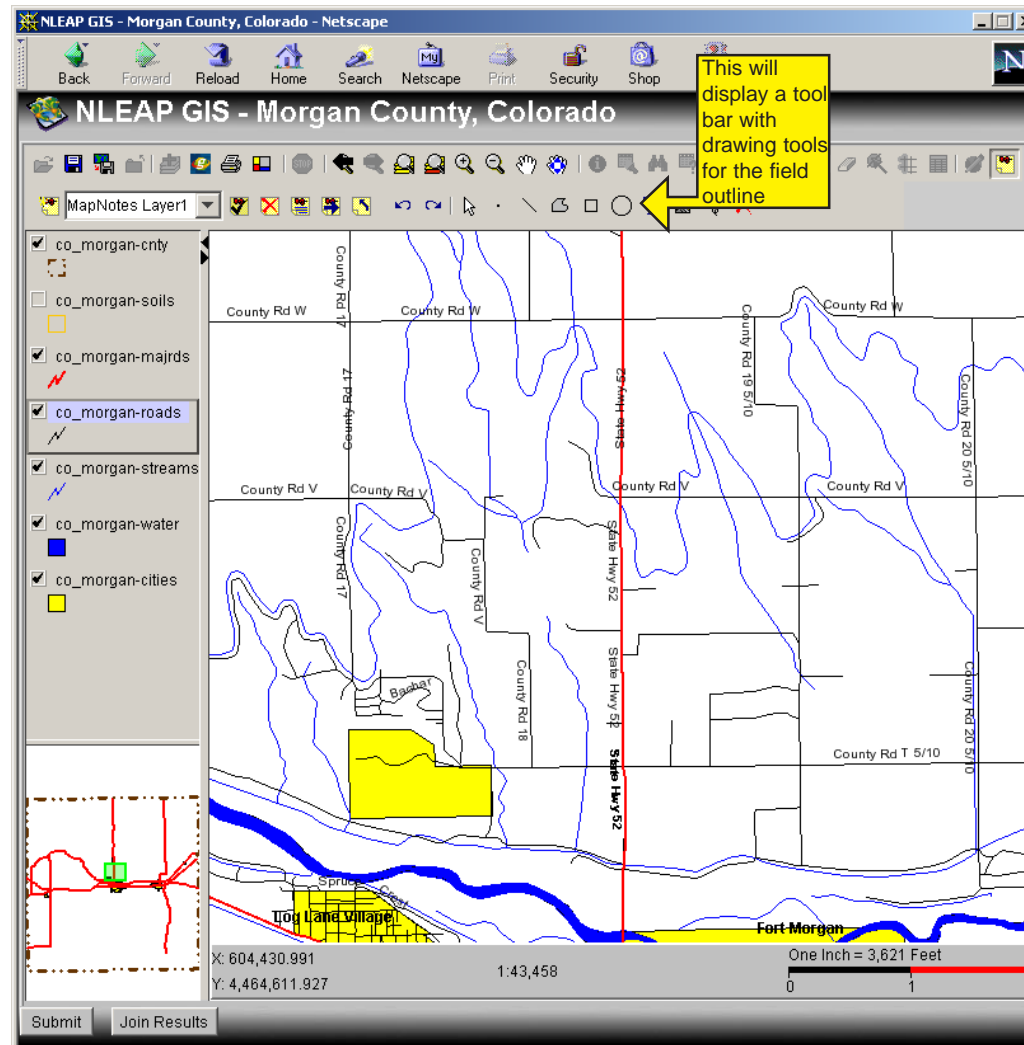







Figure 14, Drawing tools

Drawing Tools

After clicking on the layers tool, a new toolbar will appear with drawing tools for your farm boundary outline. There are tools for drawing circles , rectangles , and free drawing . If you have drawn your farm field boundary in the wrong place, click on the delete button , and the mistake will disappear. In order to redraw the boundary, you will have to click on the layers button  again, and redraw your field boundary.

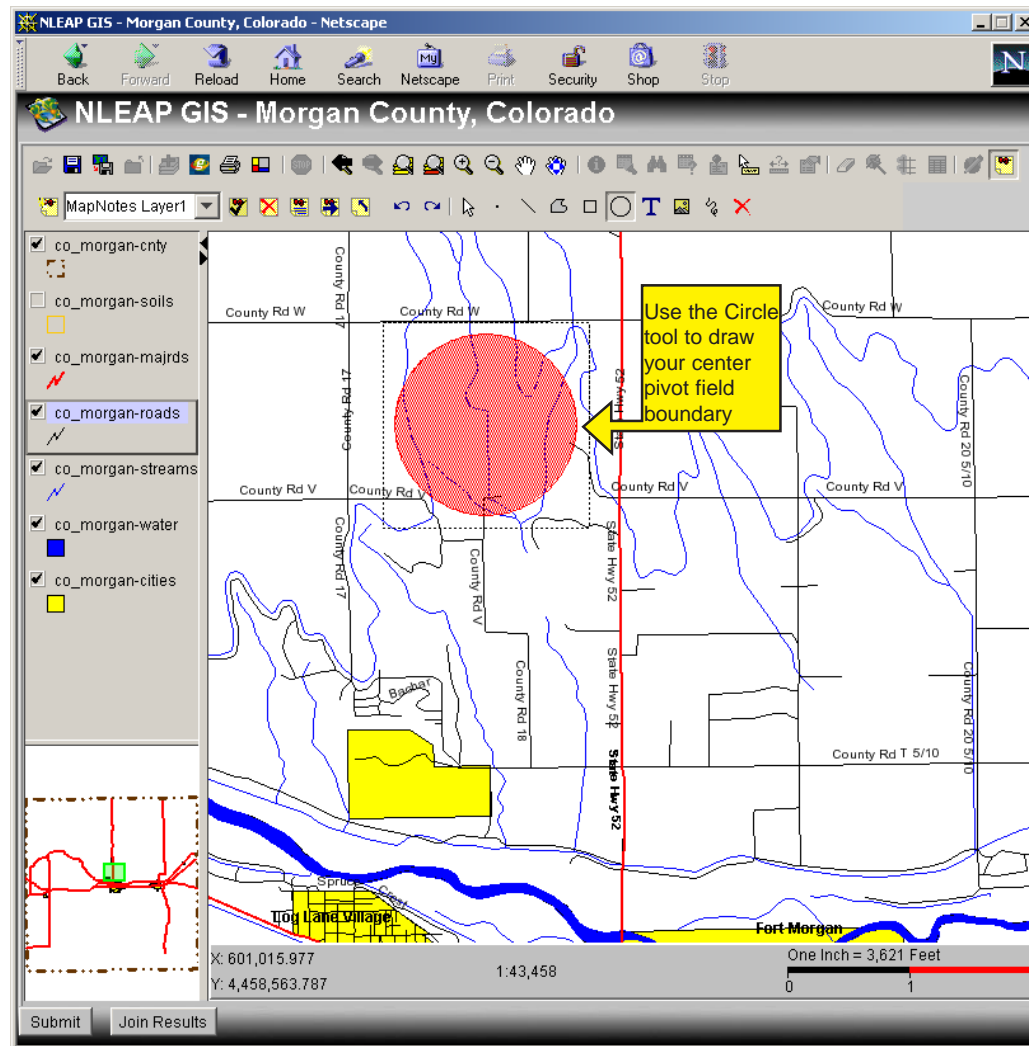




Figure 15, Center pivot field boundary

Drawing Your Field Boundary

For this example we will draw a center pivot with the circle tool. Place your cursor over the circle tool , click, and then place your cursor on the map and drag a circle. You will now see a red circle on the map representing your center pivot boundary.

Submitting a New Layer

Place your cursor over the stop button  and click. This stops the editing process for your new layer, the farm boundary. A box will appear asking if you want to submit this information. Click yes.

Intersecting Your Field Boundary With the Soils SSURGO Database

Return to the NLEAP GIS window. Place your cursor over the submit button and click. This process intersects the soils data with the new field boundary.

How does this work?

The soils database, SSURGO, is a national database that contains soils information for most regions in the country. The NLEAP server has a copy of this database. If you are looking for a particular area, in this case your center pivot, you need to input your boundary information. The server searches for your boundary coordinates in the SSURGO files, and links the soils information contained within these coordinates to your map.

An *Enter Field ID* window will appear. The default setting is F1 for the field id. Type in an original number between 1 and 99 for the field id value. You will use F80 for this example. The system will assign all soil types in your field an id value of F80.

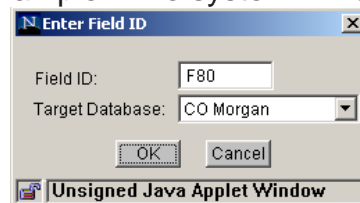


Figure 16, Field ID Window

Click OK and be patient while the computer processes the data.

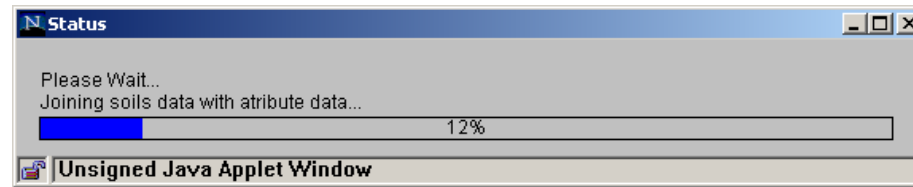


Figure 16, Status Bar

A Save As window will appear. Navigate to a directory where you will save your data, which in this example is c:\temp.

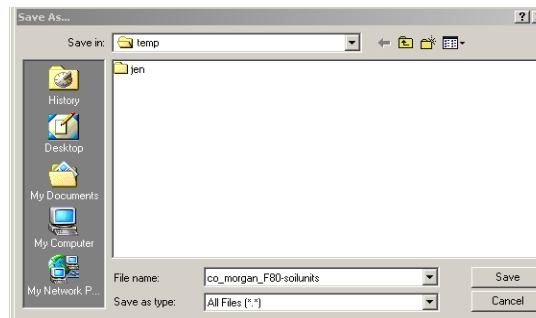


Figure 17, Save Window

Click Save when you have navigated to the correct directory. The Save As window will appear two more times, and you will simply press Save again until the window disappears. This happens because the program is saving all files associated with the soils data.

Soil Management

After the soils information is submitted, you will need to open the GIS Soil and Management tool. This tool will save all of your soil types along with your management practice scenario. Minimize the NLEAP GIS window and browse the menu. Under the *Basic Tools* menu, select *GIS Soil and Management Selection*.



Figure 17, Basic Tools Menu

A GIS Soil and Management box will appear. The left hand column contains a list of fields and soils currently identified in your personal GIS database. The right hand column contains a list of management scenarios currently available in your user database.

Scroll through the list of soil selections in the left hand column and find entries for field F80. These entries are all associated within your field boundary. Select the first F80 soil entry (or you can select multiple entries by holding down the Ctrl key). Next, scroll through the right hand column and select the event scenario of interest, (e.g., CC;CT;SA;IRR;IRI;). You will notice that the selected record(s) have been added to the relation box. Repeat this for all of the F80 records, selecting the same or alternate event scenarios. Do not select the unknown series if it is included in your group. You will encounter an error if you do select it. If you have included a record in the relationship box that should not be there, simply highlight it and hit the delete key. When finished, all entries will be in the relation box, and you will click the save button.

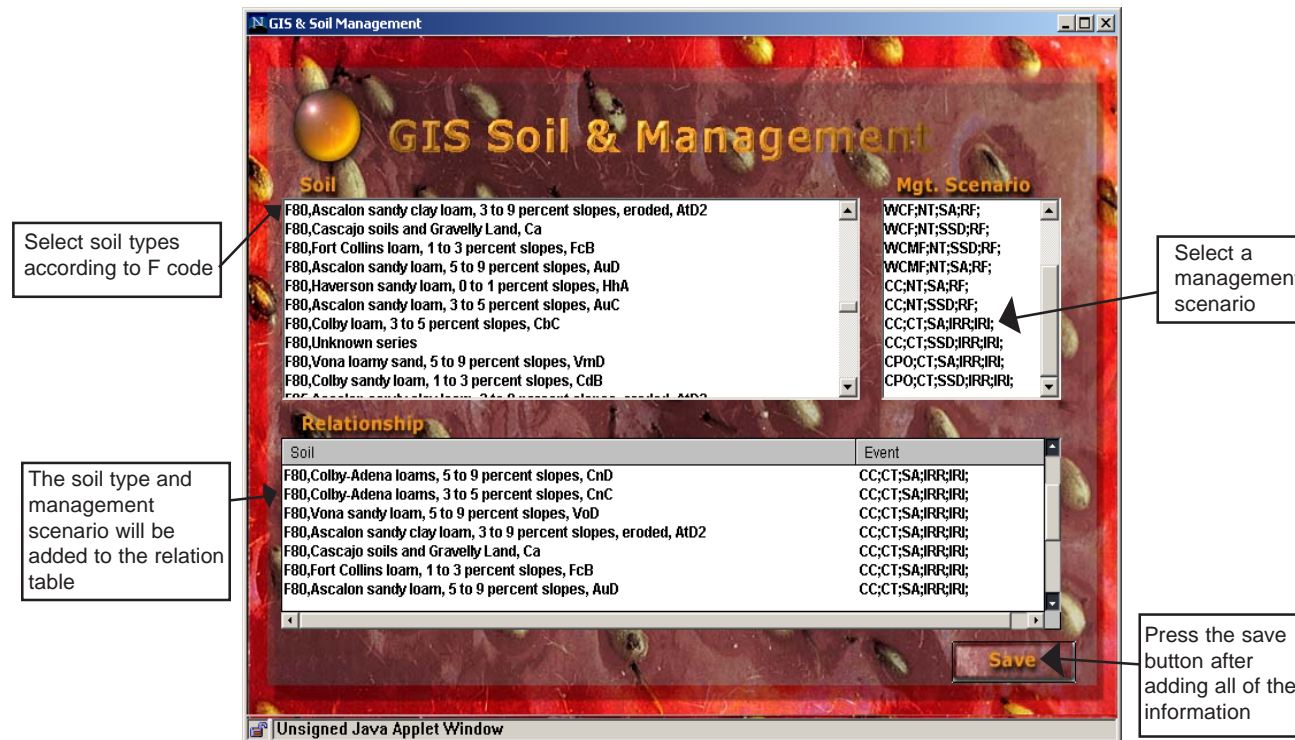


Figure 19, GIS and Soil Management Window

A Save window will appear. Type in a filename, and press the save button.

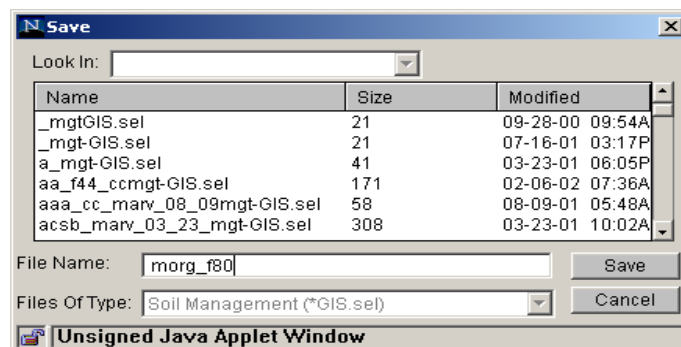


Figure 18, Save Window

NLEAP Simulation Server Tool

Before you join your results, you must run the NLEAP simulation tool in order to process your soil management scenarios. In the *Basic Tools* menu, select *NLEAP Simulation Server* and click.



Figure 19, Basic Tools Menu

A simulation window will appear. The Target Database box allows you to specify the current database. This database name identifies both the user (management and soils) and climate databases as a group. If you wish to change either the climate or soils databases, you must run the climate or soils download applets and update one of the target databases (major changes) or use the advanced soils and/or climate applets to make minor changes.

Next you will see the management source box and a graph data destination selection box. Under the management source section, click on the browse bar. A new window will appear. In the filename box, scroll through the selections and find the filename you used to save your GIS and Soil Management events. In this case, select `morg_f80`, and then click the open button. You will be brought back to the simulation window. Under the graph data destination section, click the browse button. A new window will appear. You will type in a name for your graph results in the filename box. In this case, `morg_graph`. Click open, and you will return to the simulation window. Select the box beside Display Execution Log to get a log of the simulation runs. Pressing the Details button will produce a list of soils and scenarios for this simulation.

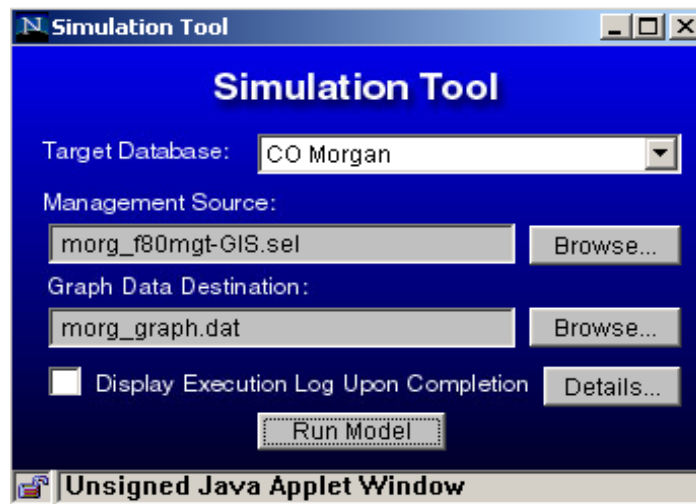


Figure 20, Simulation Window

Click the *Run Model* button and be patient while the simulation runs.

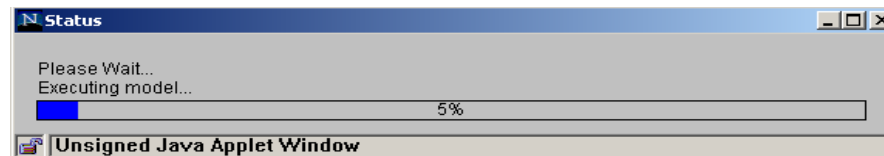



Figure 21, Status Bar

When the run is complete, the execution log will be displayed. The run status will be displayed near the end of the log. If successful, it will read "normal termination of run success". Click OK when you have finished perusing the log file, and then close the simulation window.

Adding a Layer and Joining Simulation Results to Your Map

Return to the NLEAP GIS window. To add your soilunits to your map, click on the add button . A catalog window will appear.

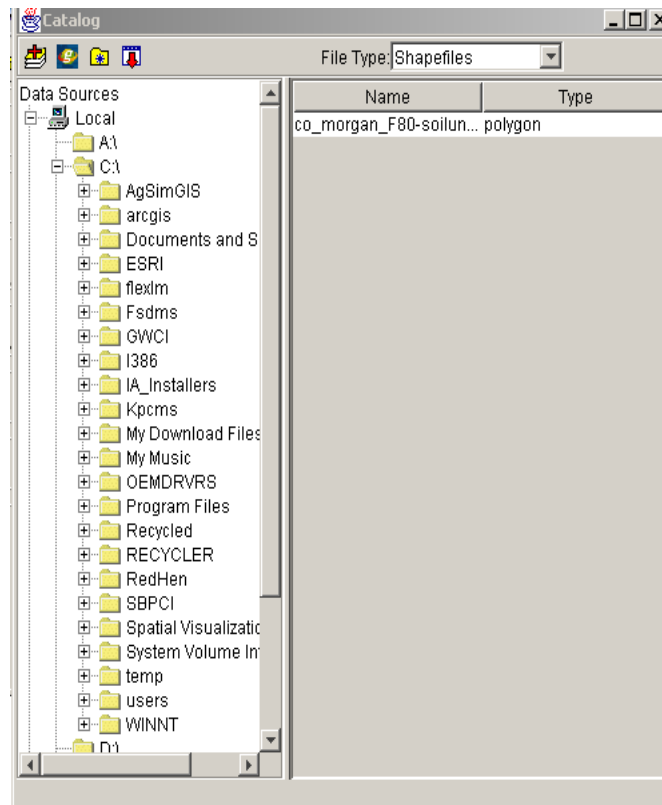


Figure 22, Catalog Window

Under the Local directory, you will navigate to your saved soils data. In this example you saved the data in the *c:\temp* directory. Click in the box next to *Local* to elicit the *c* directory. You will also need to click in the box to the left of the *c* directory in order to bring up the temp directory. Double click on the *temp* directory, and you will see your login name associated with a soilunits label in the right-hand column of the window. You will notice that the File Type is a shapefile, which is a format for storing the location, shape, and attribute information of geographic features, such as your farm boundary.



Figure 23, Filetype and Soilunits

Double-click on the soilunits label, and close out of this window to display your field with soil boundaries attached.

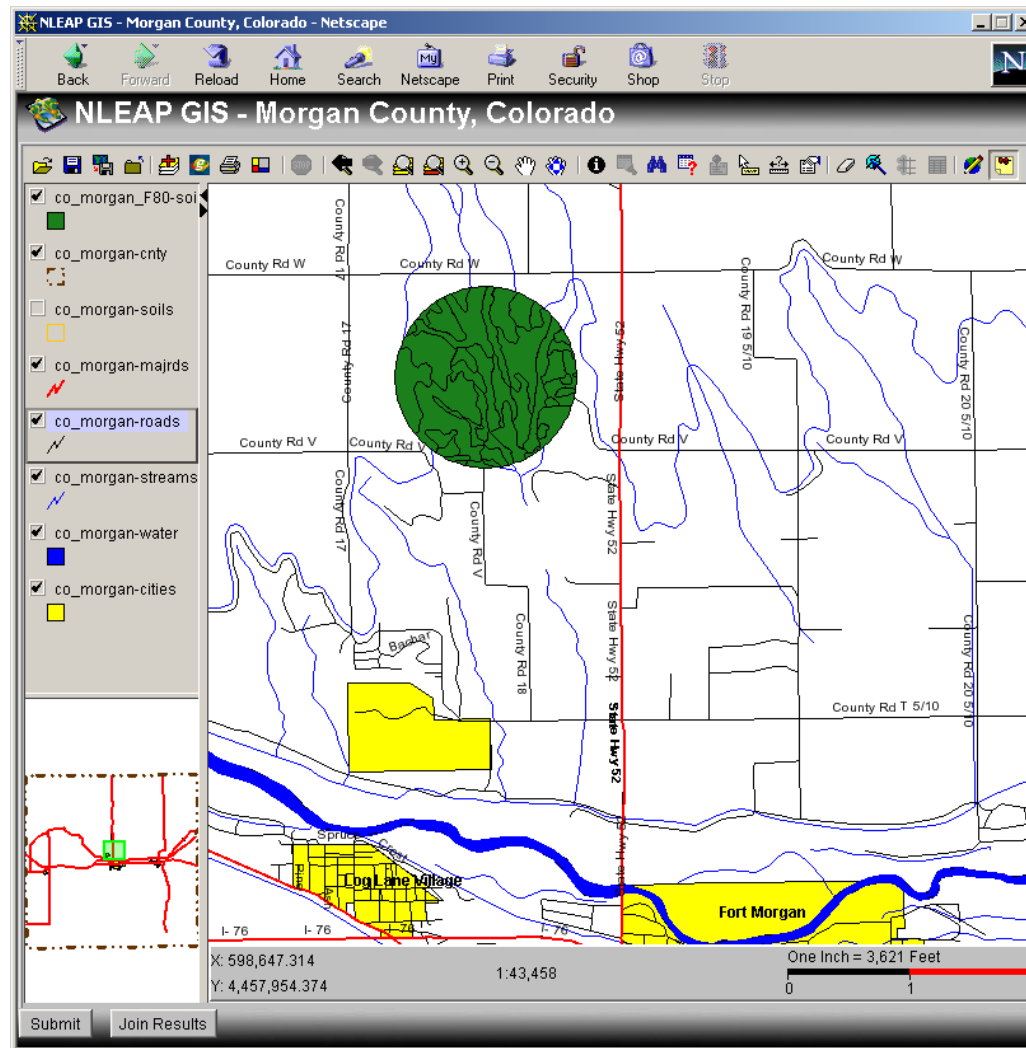


Figure 26, Center pivot with soil boundaries

You will now notice that a layer has been added to the table of contents on the left-hand side of the window, and your field now has soil boundaries drawn within it.

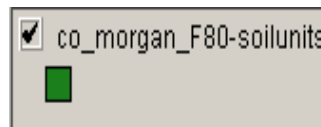


Figure 24, Soilunits Layer Label

Your farm field boundary, the center pivot, is now green and includes polygon lines that represent soil boundaries.

Note: Your boundary may be a different color than the one shown.

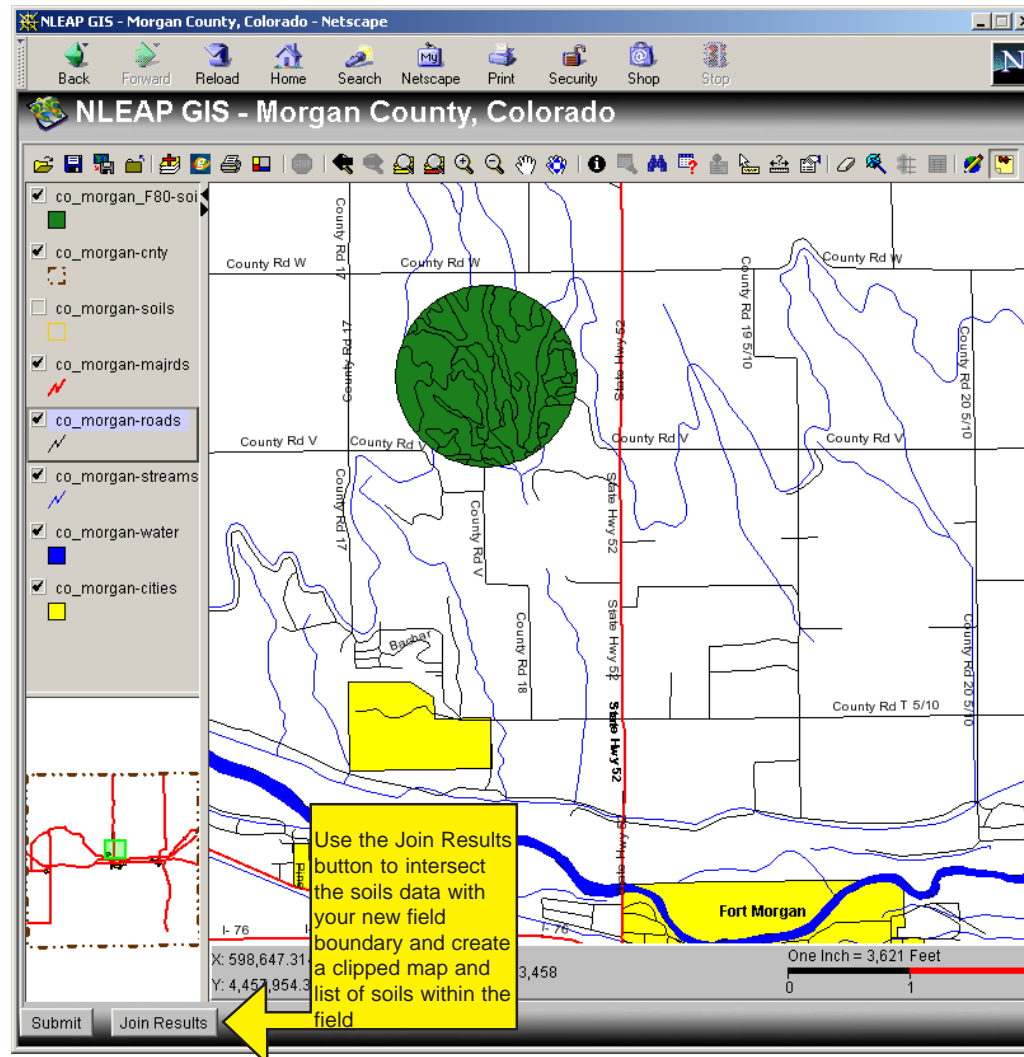


Figure 25, Joining Your Results

Joining Your Results

Place your cursor over the Join Results button and click. This process connects the most recent copy of the NLEAP simulation results table with the GIS.

Note: the results table may also contain output from previous NLEAP simulations. These can also be joined and viewed (one-at-a-time). Projects containing joined map layers can be saved (archieved) for later retrieval and display.

An *Enter Field ID* window will appear. Change the *field id* to F80, and click OK.

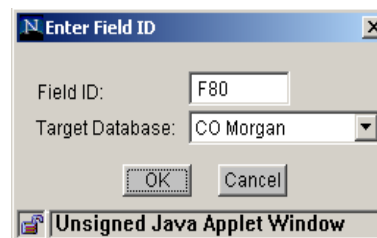


Figure 29, Field ID Window

Be patient while the computer processes the data.

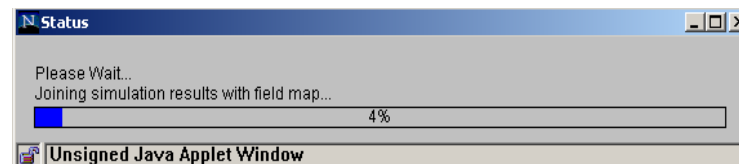


Figure 30, Status Bar

A Save As window will appear. Navigate to a directory where you will save your data, which in this example is c:\temp.

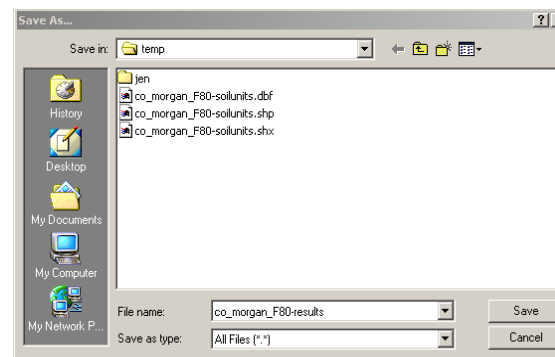


Figure 31, Save window

Click Save when you have navigated to the correct directory. The Save As window will appear two more times, and you will simply press Save again until the window disappears. This happens because the program is saving all files associated with the soils results data. You will now add the soils results to the view.

Place your cursor over the add button  and click. A catalog window will appear.

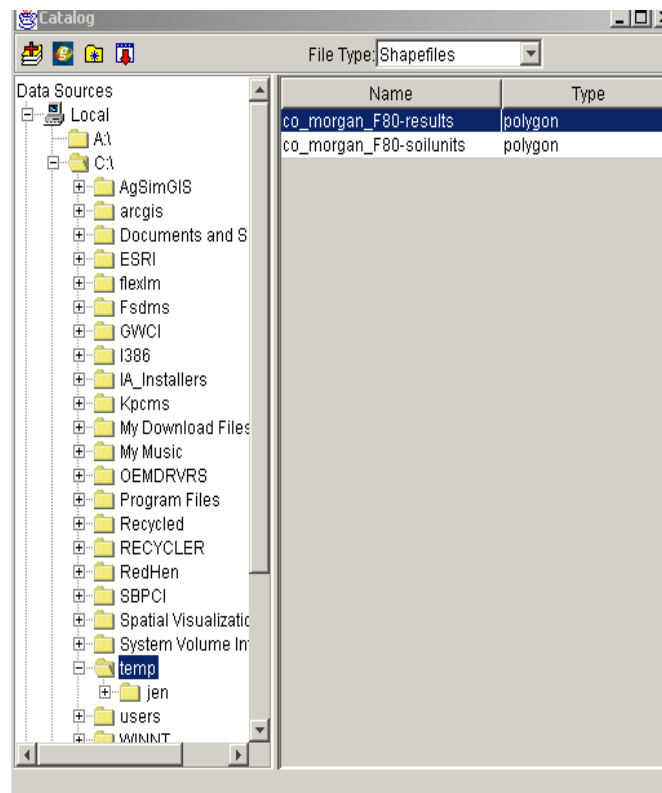


Figure 32, Catalog Window

Under the Local directory, you will navigate to your saved soils data. In this example you saved the data in the *c:\temp* directory. Click in the box next to *Local* to elicit the *c* directory. You will also need to click in the box to the left of the *c* directory in order to bring up the temp directory. Double click on the *temp* directory, and you will see your login name associated with a results label in the left-hand column of the window. If only the soilunits are displayed, click the refresh button on the NLEAP GIS steps page, and then return to the catalog box.

File Type: Shapefiles	
Name	Type
co_morgan_F80-results	polygon
co_morgan_F80-soilun...	polygon

Figure 33, Results Box

Double-click on the results label, and close out of this window to display your field with results attached.

Viewing Your Results

You will now change the symbology of the new layer. Double click on the new layer in the left hand table of contents and a Properties window will appear.

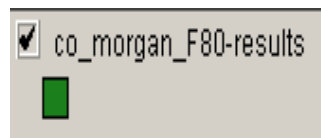


Figure 34, Results Layer

In the *Draw Features Using:* drop-down menu, choose *Unique Symbols*. In the *Field for Values:* drop-down menu, choose *NO₃-LEACH*. You will be viewing the results of nitrate leaching on your center pivot. To change the color symbols, place your cursor on the color scheme drop-down menu, and click. Choose minerals and click OK to view the changes.

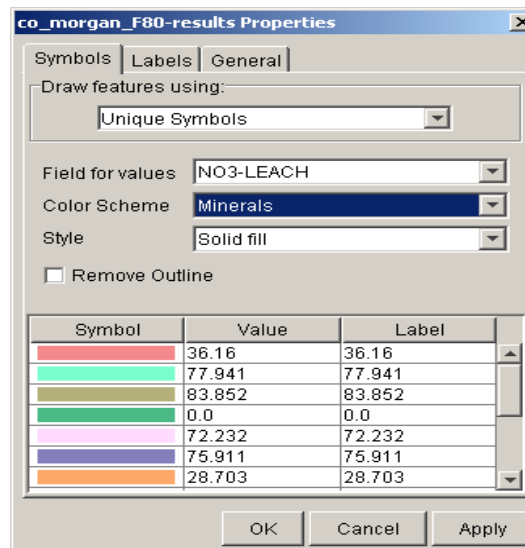


Figure 35, Properties Window

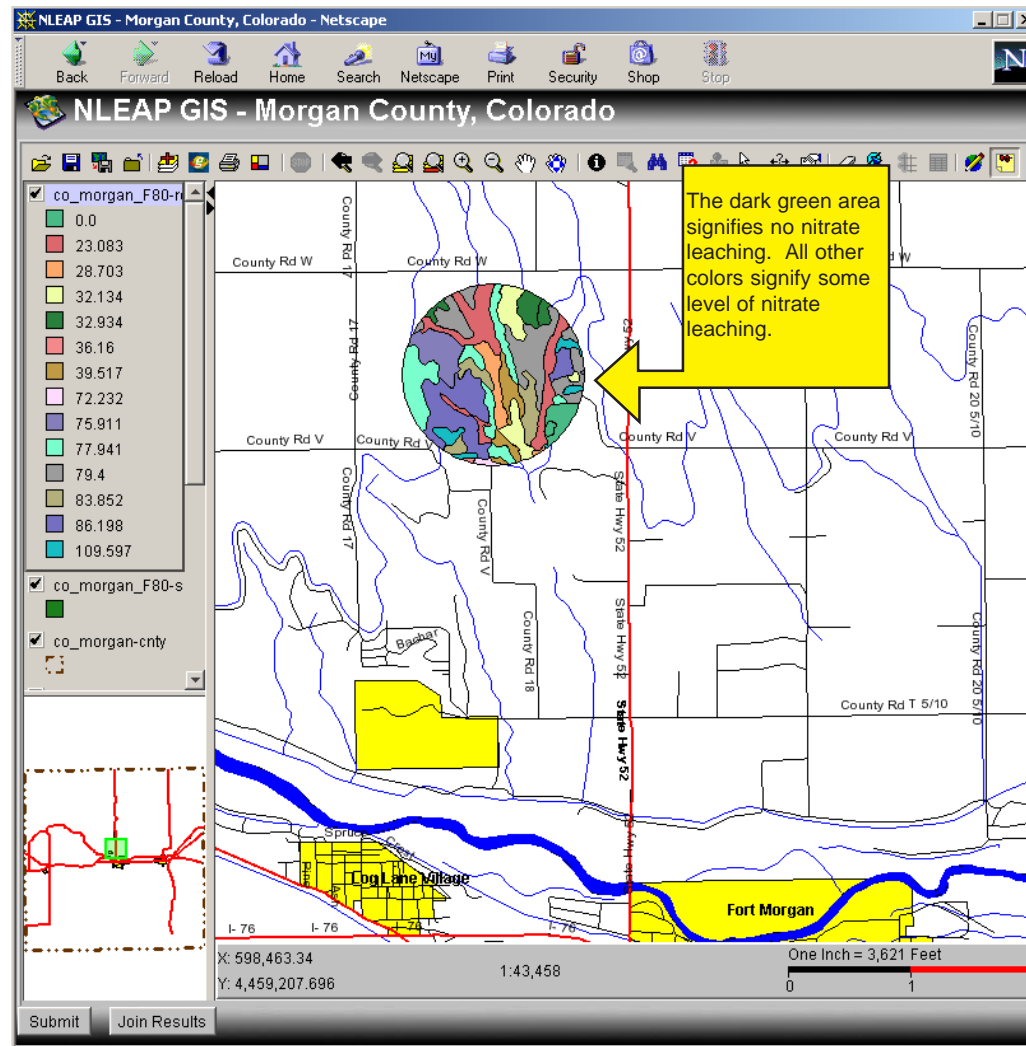


Figure 36, Nitrate leaching in the center pivot

Nitrate Leaching

You will notice that your center pivot is no longer all one color. The dark green areas on the center pivot represent areas with no nitrate leaching. All other areas have some degree of nitrate leaching. View the legend to locate high areas of nitrate leaching. The teal blue areas on the map represent the highest levels of nitrate leaching. Units are lbs/ac/year of $\text{NO}_3\text{-N}$.

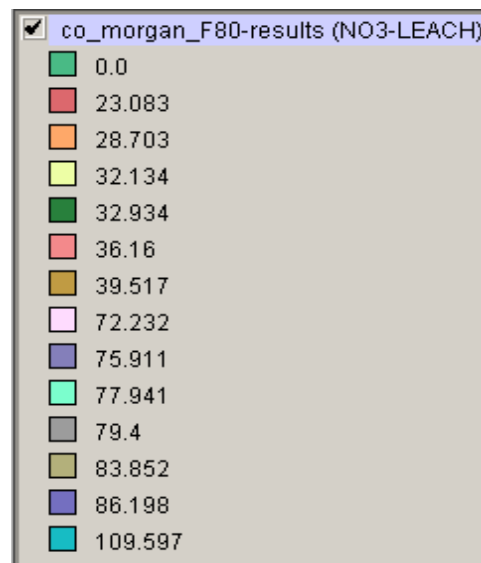


Figure 37, Nitrate leaching legend

N₂O Emissions

Again double click on the soilunits results legend. A properties window will appear. In the *Draw Features Using:* drop-down menu, choose *Unique Symbols*. In the *Field for Values:* drop-down menu, choose *N₂O Emitted*. You will be viewing the results of N₂O emissions on your center pivot. To change the color symbols, place your cursor on the color scheme drop-down menu, and click. Choose Bountiful Harvest and click OK to view the changes.

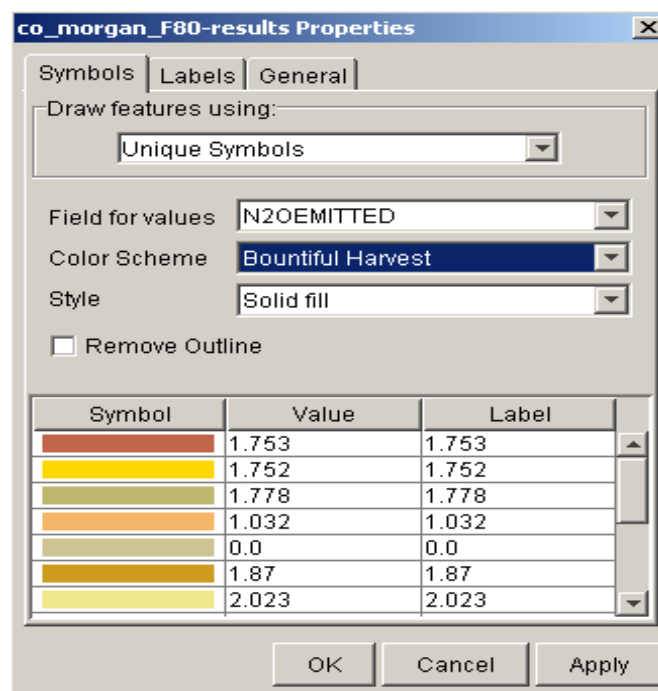


Figure 38, N₂O emissions properties window

The legend for N₂O emissions is displayed in the left hand column table of contents. Notice that the tan color represents no N₂O emissions, while the yellow color represents the highest occurrence of N₂O emissions. Units are lb/ac/year of N₂O-N.

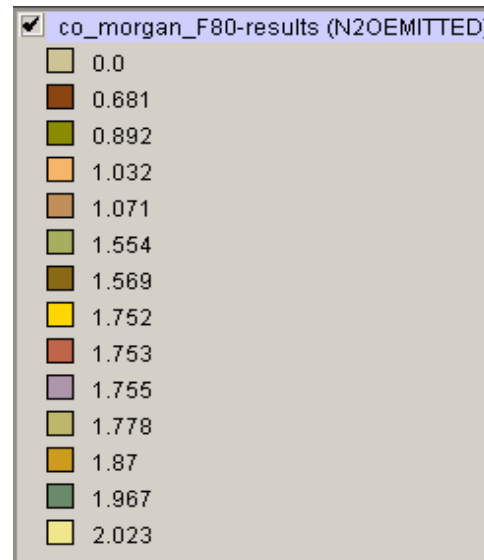


Figure 39, Legend of N₂O emissions

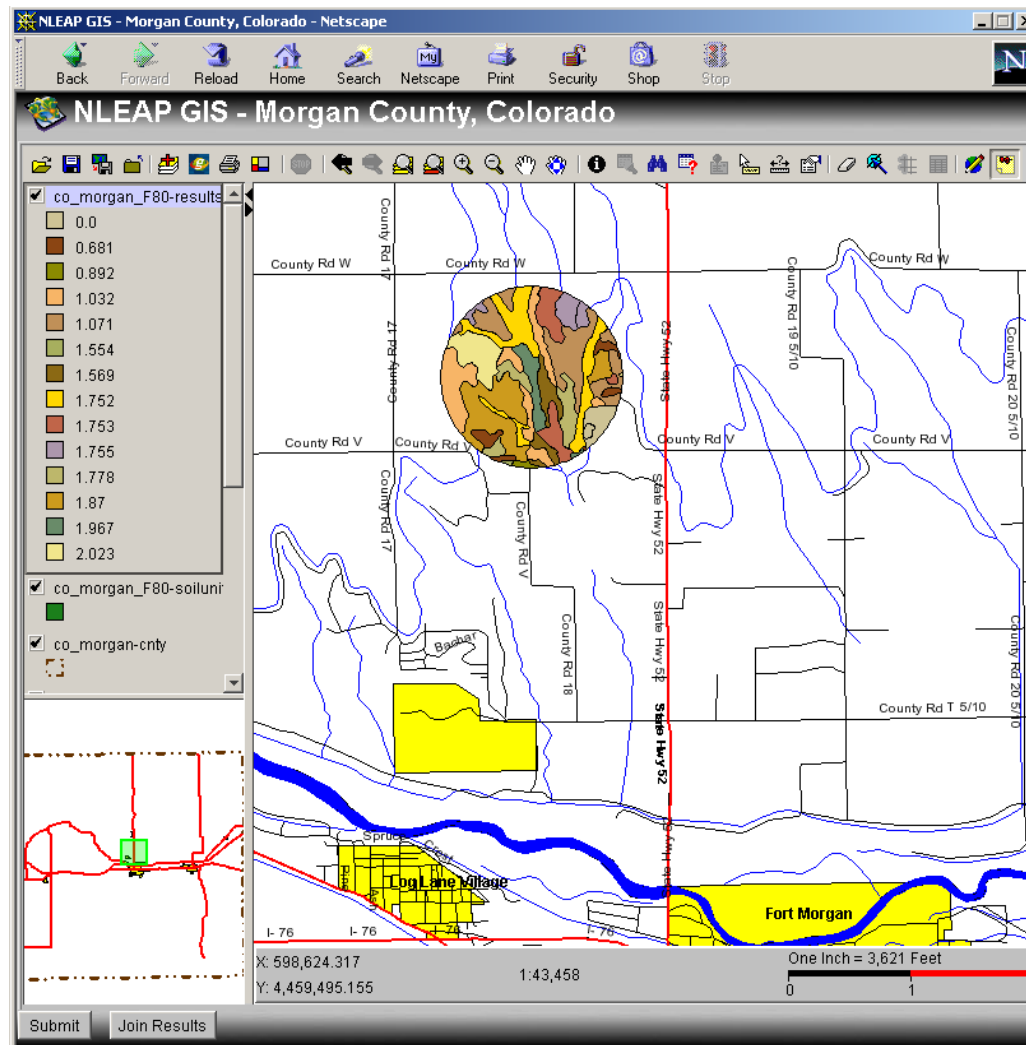


Figure 40, N₂O emissions

Nitrates ($\text{NO}_3\text{-N}$) and nitrous oxide (N_2O) are forms of Nitrogen that are of major environmental concern. Once nitrate is formed, its movement in soil and potential for contamination of groundwater depend on several factors including management, soil characteristics, location, and characteristics of the underground water formations, as well as climatic conditions. In this example, the nitrate leaching units ranged from 0-105 lbs/acre/year of nitrogen (N). Generally 100 lbs/acre/year or greater of N leaching signifies a significant concern for groundwater contamination. Leached N levels of over 100 lbs/acre/year occurred in the lower center of the pivot in this example.

In the N_2O emissions example, the data ranged from 0-2 lbs/acre/year of $\text{N}_2\text{O-N}$. An emissions value of 10 lbs/acre/year of N or higher would signify concern of significant potential impact on global climate change. In this example, the center pivot is within acceptable levels for N_2O emissions.

Change the soil results properties box so that $\text{NO}_3\text{-N}$ residuals are displayed. The values in this example should range from approximately 0-200 lbs/acre/year of N. Acceptable levels of $\text{NO}_3\text{-N}$ residuals fall below 50 lbs/acre/year of N. In this example, there are quite a few areas that fall above the acceptable limit for $\text{NO}_3\text{-N}$ residuals. In this case, farm practices should be re-evaluated for a sound management scenario.

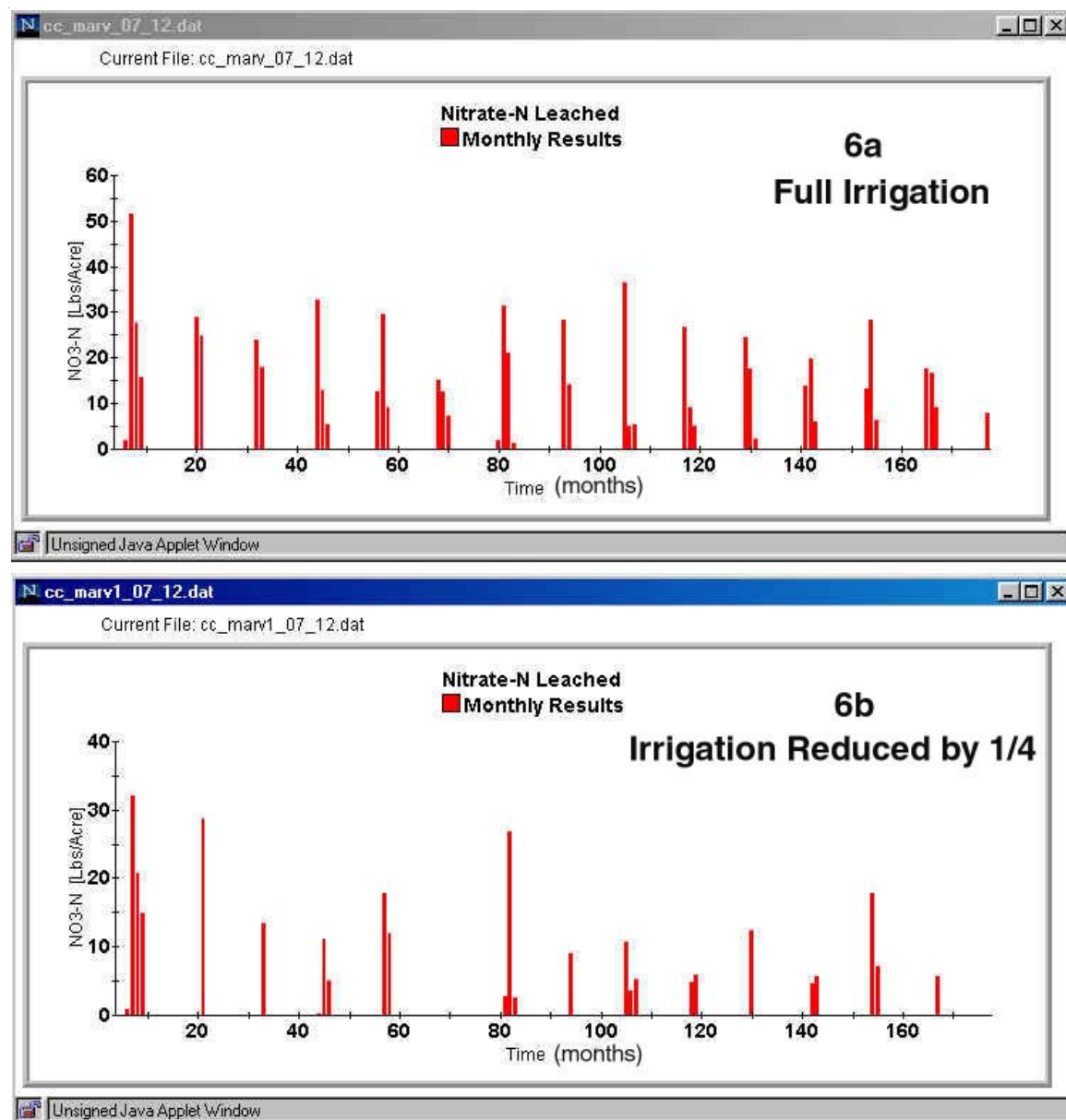


Figure 41. Management analysis example.

Management application example

The NLEAP Internet client-server system was used to quickly determine how $\text{NO}_3\text{-N}$ leaching from different soils in a field would change in response to a reduction in amount of applied irrigation water. In this test scenario, the user had available soil survey map layers for local NRCS SSURGO soils data, a previously downloaded NRCS MUIR soils attribute file and NRCS NWCC climate database files, and a long-term management scenario for the default cropping system of continuous irrigated corn. This type of information would typically be available in an NRCS State or field office. The field boundaries were drawn on a base map layer of the county roads and then intersected with the NRCS SSURGO soils mapping layer. This produced a list of soil mapping units that was written to a file accessible by the GIS Soil and Management Selection applet. This applet allows the user to associate predefined management scenarios with each soil in the field. In this instance, we assigned the same continuous irrigated corn scenario to each soil. Precision agriculture applications would involve multiple scenario assignments. After saving this management suite for the field, the Simulation Applet was then used to select and run all the soils in the field for 14 years. The bar graph (Fig. 41a) shows the monthly results for $\text{NO}_3\text{-N}$ leached over this period for the Colby loam soil. Note that annual dynamic steady-state with respect to $\text{NO}_3\text{-N}$ leached was reached after about 9 or 10 years at about 42 kg N/ha/yr for the irrigation rate of 71cm/year. Steady-state was determined when a running average of annual $\text{NO}_3\text{-N}$ leached for the past 3 years changed less than 10%.

The same set of simulations was then repeated except that the irrigation amounts were reduced by 25% to 53 cm/yr. The monthly $\text{NO}_3\text{-N}$ leaching results for this scenario are plotted in Fig. 41b. The annual steady-state values for $\text{NO}_3\text{-N}$ leached of about 15kg N/ha/yr are lower than those shown in Fig. 41a for the higher irrigation rate. Although N input to the system was the same in both cases, the lower irrigation rate allowed a higher crop N uptake efficiency and therefore a reduced value for steady-state leaching of $\text{NO}_3\text{-N}$. In general, the amount of water applied controls the concentration of $\text{NO}_3\text{-N}$ in the steady-state leachate, but not the mass except in cases such as this where modified leaching of N also impacts another sink¹⁹. The time to steady-state is related to the amount of water applied with higher irrigation amounts producing shorter times to steady-state and vice versa.

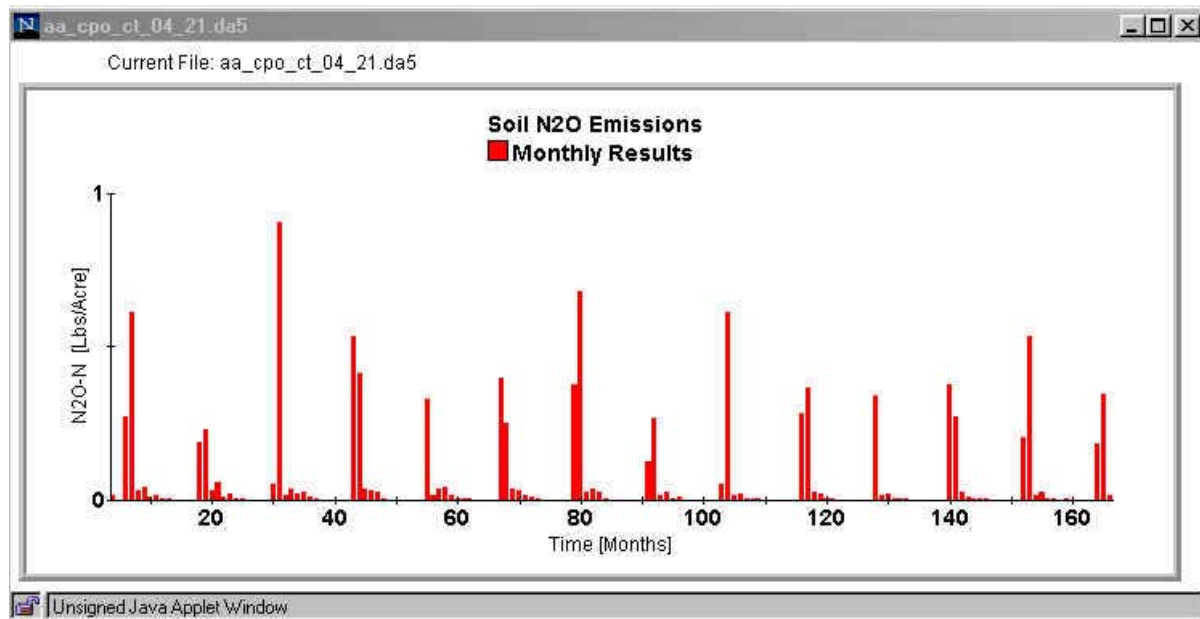
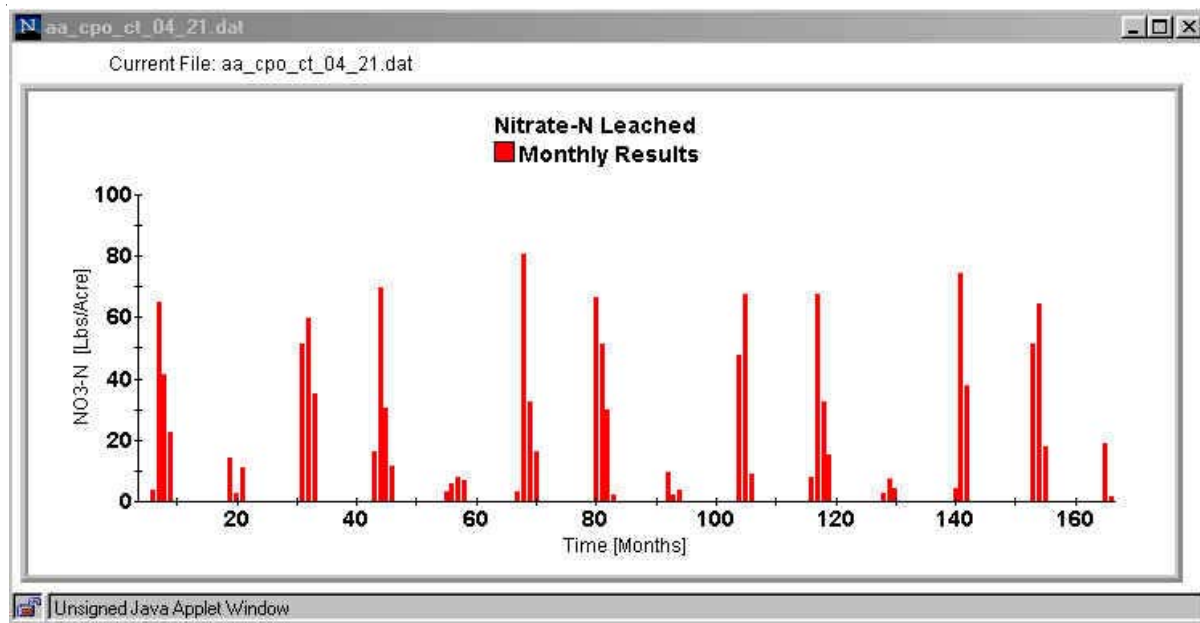


Figure 42. NO₃-N leached and N₂O-N emitted for a CPO crop rotation.

Optimizing management scenarios for reduced NO₃-N leaching and N₂O emissions.

Potential problem soils for NO₃-N leaching and N₂O emissions such as those illustrated in Figures 36 and 40 should be analyzed further to identify the most sensitive portions of the management and climate cycles. For example, the soil in Figure 36 showed over 100 lbs/ac/yr NO₃-N leached at steady-state. This soil should be selected for a separate graphical and mass-balance analysis focused on the entire leaching sequence from current conditions to steady-state. This can be done by re-running the NLEAP simulation tool for this soil, management, and climate; saving the graphics file; and then viewing the long-term graph and associated mass-balance results. There are two ways to accomplish this task, but from within a GIS study the easiest method is to use the GIS Soil and Management (SAM) Applet to select this soil and then attach the appropriate management scenario. Appropriate graphics and mass-balance files will be saved when the Simulation Server is executed on the file saved from the GIS SAM Applet. The alternate method of using the Quick or Detailed Analysis Wizards to select the appropriate scenario for the Simulation Server could also be used. In fact, the Quick or Detailed Wizard tools must be used for all analyses in cases where GIS coverages are not available.

Figure 42 shows long-term graphical output for NO₃-N leaching and N₂O emissions for a Vona loamy sand and the CPO;CT;SA;IRR;IRRI (corn-potato-onion; conventional tillage; single fertilizer application; and irrigated) management scenario. Dynamic steady-state is often reached after a few crop rotation cycles covering a period ranging from about 10 to 30 years depending on the crops, soils, and climate involved. In this example, dynamic steady-state for NO₃-N leached occurred after about 10 years. Note that more NO₃-N was leached under the corn and onions compared to the potatoes suggesting improved management is needed in these portions of the rotation. Also note that N₂O emissions were still not at steady-state after 14 years indicated a longer simulation is needed.

Simulation Tool

The simulation tool provides access to the NLEAP simulation server. You will select a management database from the drop-down list and a filename for a previously defined management scenario. Soils data are used according to the previous soil type selection. Once a long-term simulation has been completed, results are saved to a file that you specify and status messages are provided as feedback during the simulation both in the error message window of the simulation applet and in the file named *message.fil* on your account.

You Will Learn:

- *How to select a management source
- *How to select a graph data destination

In the *Basic Tools* menu, place your cursor over *Simulation*, and click.



Figure 43, Basic Tools Menu

A simulation window will appear. There will be a Management Source section and a Graph Data destination section. Under the management source section, click on the browse bar. A new window will appear. In the filename box, scroll through the selections and find the filename you used when you saved your GIS and Soil Management events. In this case, select morg_f80, and then click the open button. You will be brought back to the simulation window. Under the graph data destination section, click the browse button. A new window will appear. You will type in a name for your graph results in the filename box. In this case, morg_graph. Click open, and you will return to the simulation window.

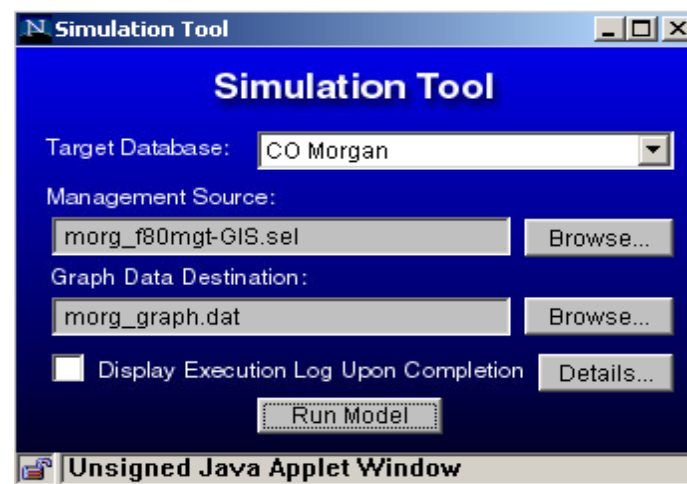


Figure 44, Simulation Window

Click the *Run Model* button and be patient while the simulation runs.



Figure 45, NRCS Water and Climate Database

Climate Download Tool

This tool allows you to download daily climate data from the NRCS climate data website for use in NLEAP. These data include daily precipitation, and maximum and minimum air temperature. Pan evaporation data are generated with a simulation algorithm within the NLEAP climate server during download.

You will learn:

- *How to select a state of interest and a climate station
- *How to select a target database for your climate data
- *How to generate a log file

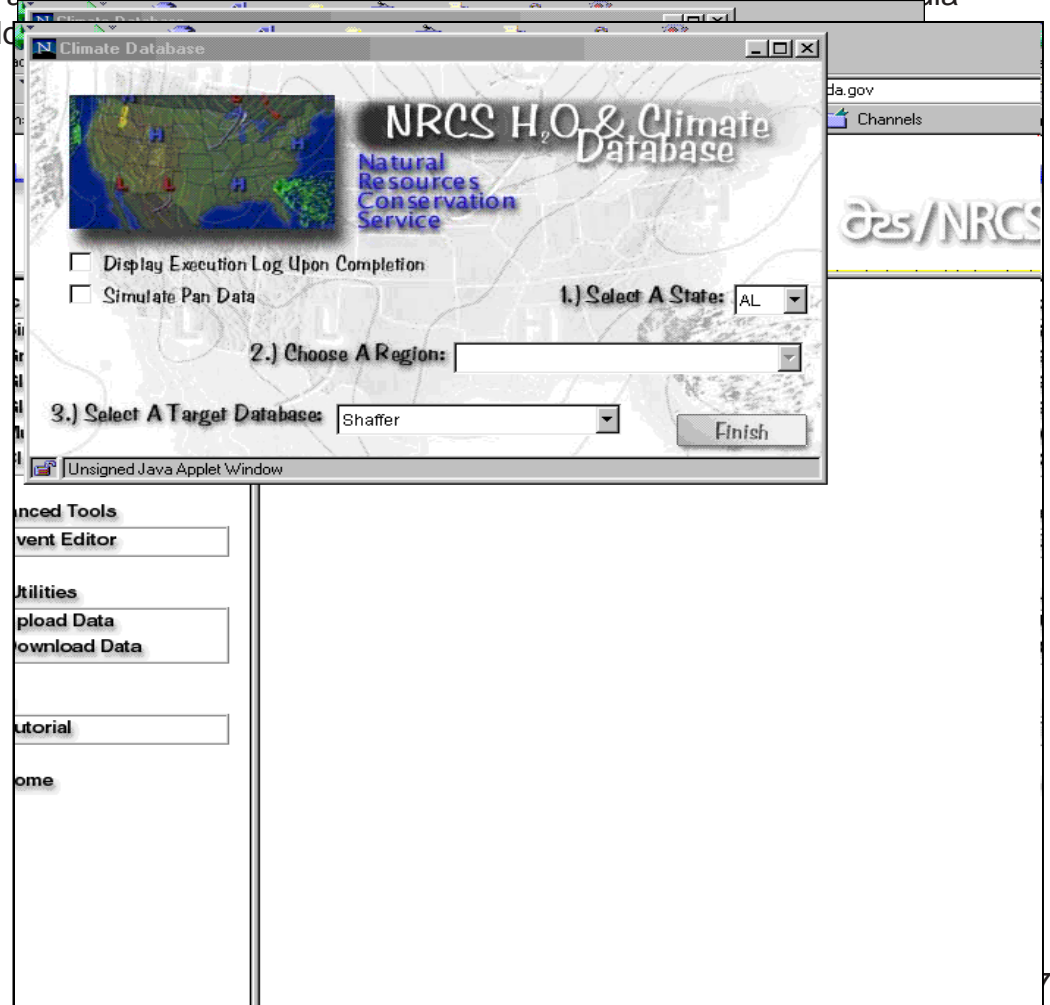







Figure 46, Climate Database Window

Downloading Climate Data

The climate data applet allows you to download and format daily climate data for NLEAP. First you must place your cursor on the arrow next to *Select a State* and click. A drop-down menu will appear. Select a state, in this case Colorado

1.) *Select A State:*  , and click. This will elicit a list of climate stations within the state. Place your cursor on the arrow next to *Choose a Station*, and click. A drop-down menu will appear. Select a station, in this case Estes Park

2.) *Choose A Region:*  , and click. To select a target database, place your cursor on the arrow next to *Select a Target Database*, and choose a database. You may have several databases in your account, so you must select the one you want this dataset to be placed in. To generate a log file of the download process, place your cursor in the box next to *Display Execution Log upon Completion*, and click ☒ *Display Execution Log Upon Completion* . Press the finish button  to begin the download process. A status bar will indicate the progress of the operation.

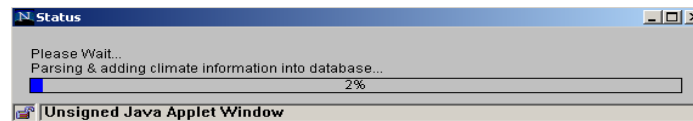


Figure 47, Status Bar

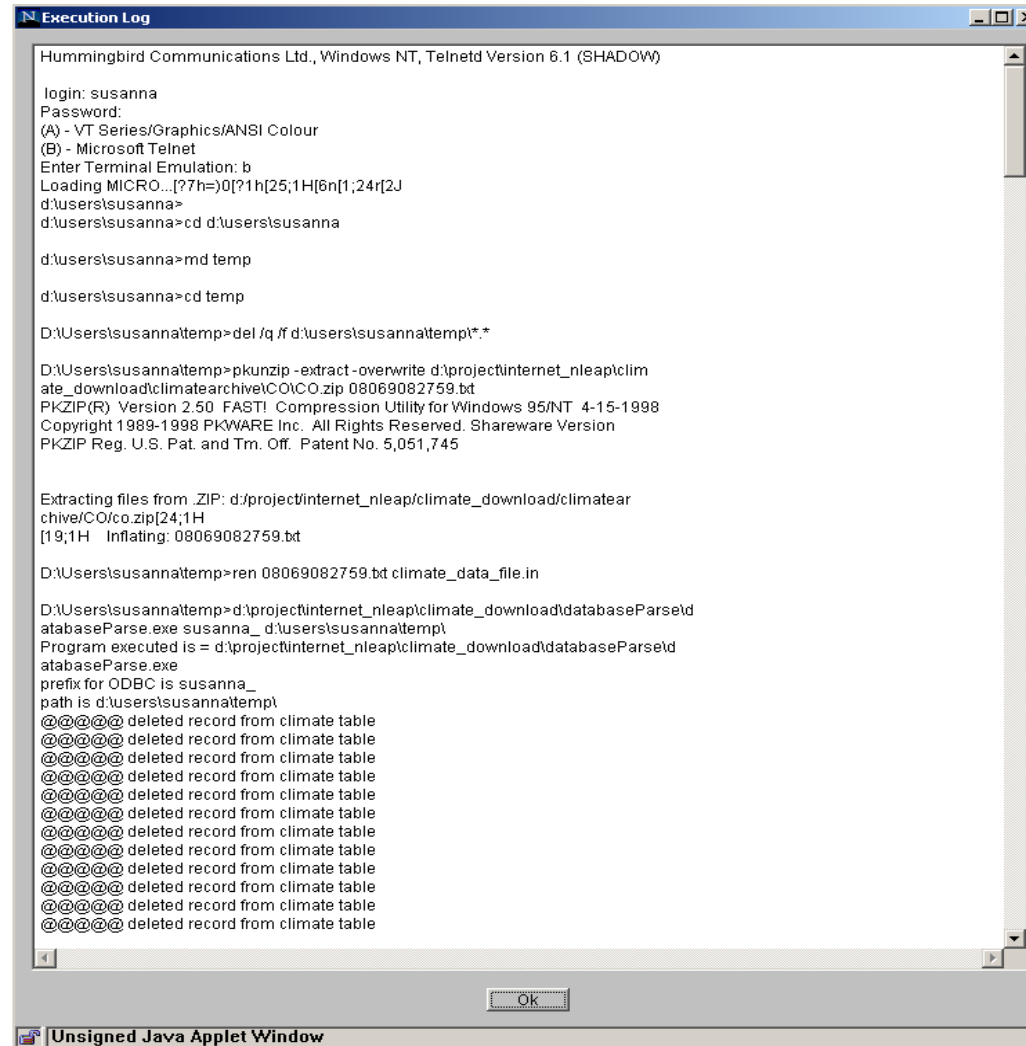


Figure 48, Climate execution log

Climate Execution Log

When the procedure is complete, you will view the execution log. This gives you a variety of information about what happened during the download and conversion process to the NLEAP database tables. If your run was successful, the end of the log will read “run success”. Some information from the old table may be replaced with new data. **You will need to check your climate data for missing or incomplete records. These need to be deleted along with all other climate records for that year.**

Graphics Tool

The graphics tool creates and displays bar graphs of selected output from the NLEAP model. These include graphs of monthly results for $\text{NO}_3\text{-N}$ leached, residual $\text{NO}_3\text{-N}$ in the soil profile, N_2O emissions, N denitrified, N lost in surface runoff, and crop uptake of N.

You will learn:

- *How to select different types of graph files
- *How to display the graph files

In the *Basic Tools* menu, place your cursor over *Graph Results* and click.



Figure 49, Basic Tools menu

A Graph Tool window will appear. Place your cursor over the *Run Graph* button, and click.

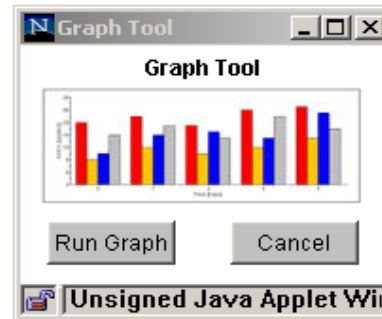


Figure 48, Graph Tool Window

A dialog window will appear that connects you to the NLEAP system.



Figure 50, Connection Status Window

Selecting Graph Files

Once you have clicked the Graph Results button, an open window will appear that contains a list of current graphics files available from NLEAP simulations.

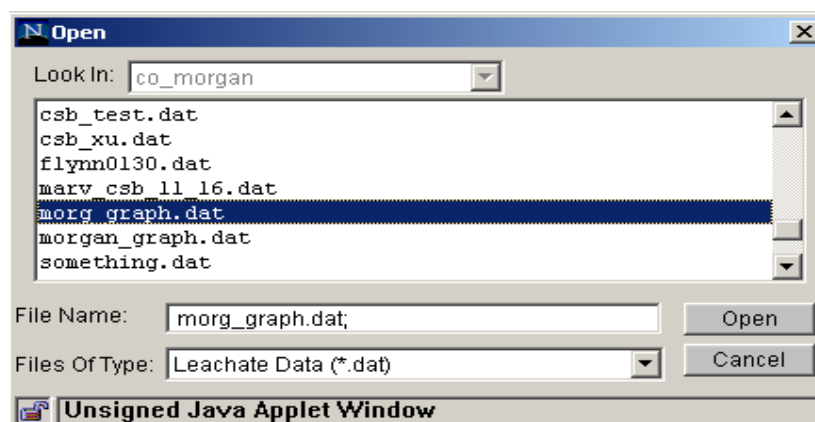


Figure 51, Open Window

In the *Files of Type* drop down menu, you will notice that the files are grouped according to type. The .dat files are represent nitrate and leached data. The .da2 files are residual nitrate N data. The .da3 represent crop N uptake. The .da4 are N denitrified. The .da5 represent N₂O emissions data, and the .da6 are N Runoff. You will choose a .dat file for this example. Make sure that .dat is selected in the *Files of Type* drop down menu. Scroll through the selection of data, and choose morg_graph.dat.

Click the open button, and a bar graph will appear.

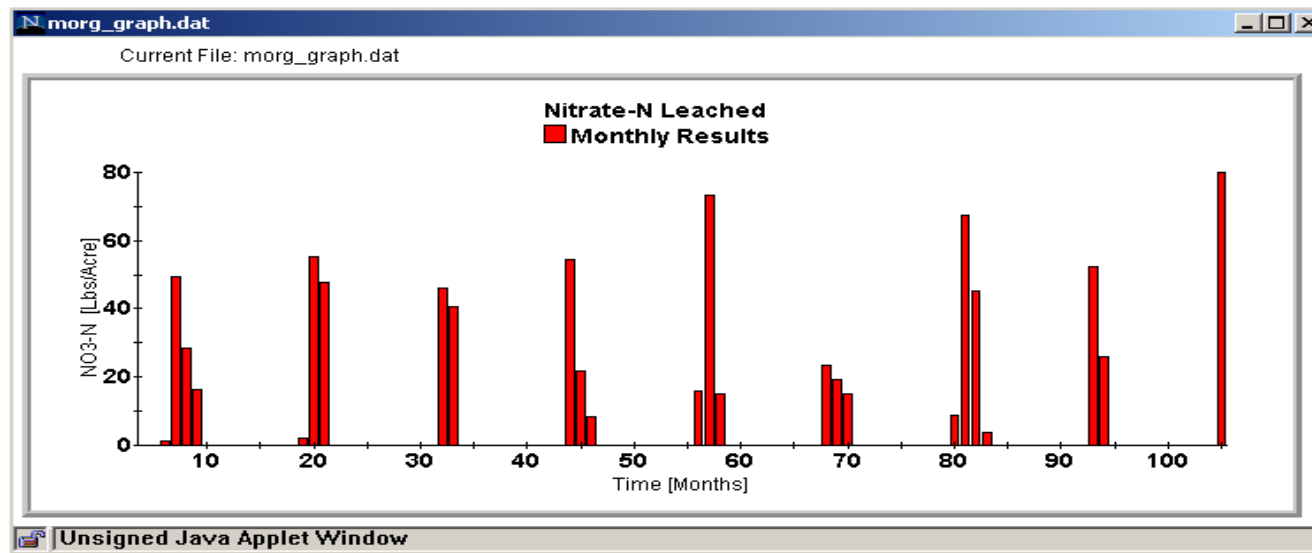


Figure 52, Nitrate Leaching bar graph

A bar graph containing the results of the nitrate leaching data is displayed. You can place your cursor on top of each bar to get the individual numbers for a particular bar. Multiple bar graphs can be displayed by selecting several input files at the same time or by re-running the Graph Applet. Individual bar graphs can be iconized to the tool bar and recalled later as needed. The graphs will remain open on your desktop until you close them or exit NLEAP. Graphs can be copied to the clipboard by clicking on the appropriate window and then pressing CTRL Print Scrn. You can then paste them into your word processor document through tools such as Microsoft Word.

N₂O Emissions

You will now go through the same process to display the N₂O emission results. The open window should still be displayed in the background. If not, click the *Run Graph* button again, and it will appear.

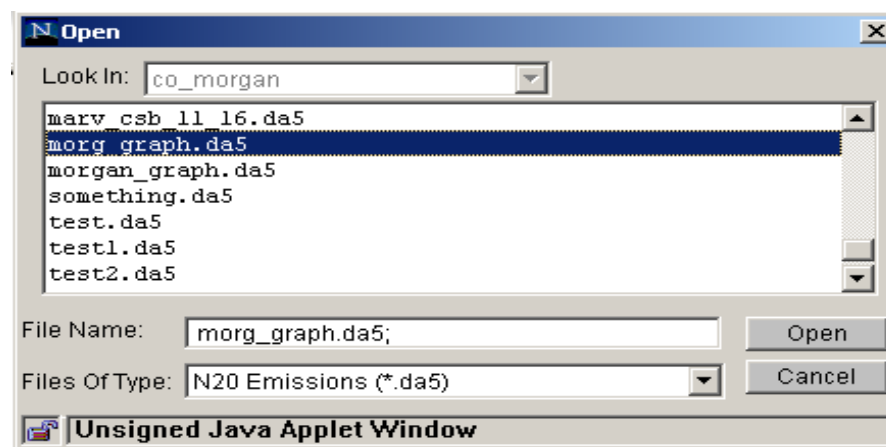


Figure 53, Open Window

In the *Files of Type* drop down menu, select .da5, N₂O Emission. Scroll through the menu and again select morg_graph.

Click the Open button.

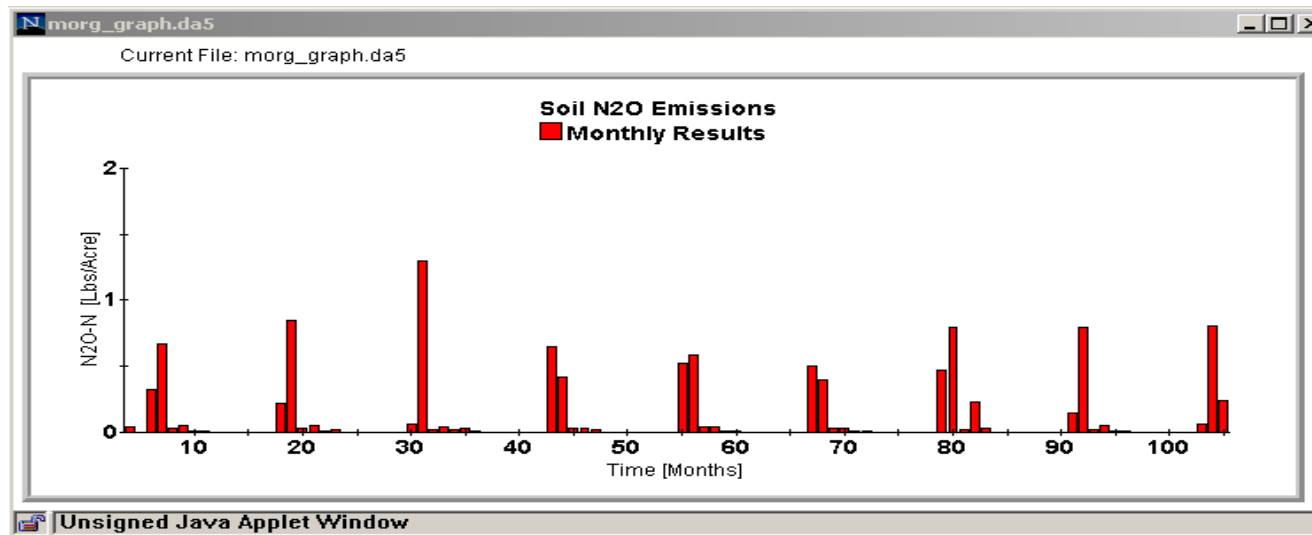


Figure 54, N₂O Emissions bar graph

A bar graph with the N₂O Emissions results will now be displayed. You can minimize, move, or align both graphs for easy comparison. You can also use the print screen tool to extract this graph window to the clipboard. Use the control v option to insert the graphs into a Microsoft Word document.

Detailed Management- Introduction

The detailed management applet displays records from an event type and management scenario. This tool provides access to the event database containing the details of all the management events for each scenario over approximately a 10 year period. Several event databases can occur on the user's account and each database may contain many scenarios. The scenario code is used to select a particular management time sequence of interest, while management type code narrows the selection to a particular management group for that scenario. These groups include crop information, fertilizer, manure, tillage, and irrigation. Once a scenario code and management group have been selected, the Next and Previous buttons are used to preview each management event in the database for that category. Management events can be edited or deleted; or new events can be added. This tool is designed to allow user Event table viewing and minor modifications. It should not be used to make major changes such as the addition of a new management event scenario. This is an advanced procedure and should be done off-line using the Event table tools provided within your MS Access user database.

You will learn:

- *How to display a management event record.
- *How to print a record .
- *How to modify an event record or add a new record.

Management Wizard

Place your cursor on *Management Details* in the *Detail Editor Wizards* box and click.



Figure 54, Detail Editor Wizards box

A Wizard box will appear. Select the target database, and click OK.

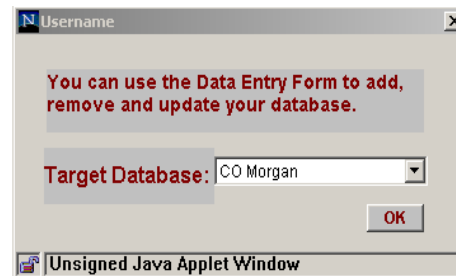


Figure 55, Target Database box

Data Entry Form

Event Data Entry Form

[Print](#)

EVENTID	<input type="text" value="4"/>	NH4%	<input type="text" value="0.00"/>
MUID	<input type="text" value="10101"/>		<input type="text" value="0"/>
MONTH	<input type="text" value="9"/>		<input type="text" value="0"/>
DAY	<input type="text" value="15"/>		<input type="text" value="*"/>
YEAR	<input type="text" value="2000"/>	Method of APP.	<input type="text" value="Knifed/Injected"/>
EVENTTYPE	<input type="text" value="NUTC"/>	Fert.APP.(Lbs/ac)	<input type="text" value="600."/>
Fertilizer Type	<input type="text" value="Anhydrous ammoni"/>		<input type="text"/>
%Nitrogen	<input type="text" value="83"/>		<input type="text"/>
NO3%	<input type="text" value="*"/>	Mgmt.scenario	<input type="text" value="WF,NT,SA,RF;"/>

Select an event type:

▼

[Click to get Management Scenario:](#)

[Restart](#)

[|<<](#) [<<](#) [>>](#) [>>|](#) [Undo](#) [Add](#) [Delete](#) [Update](#) [Save](#) [Save All](#) [Retrieve](#)

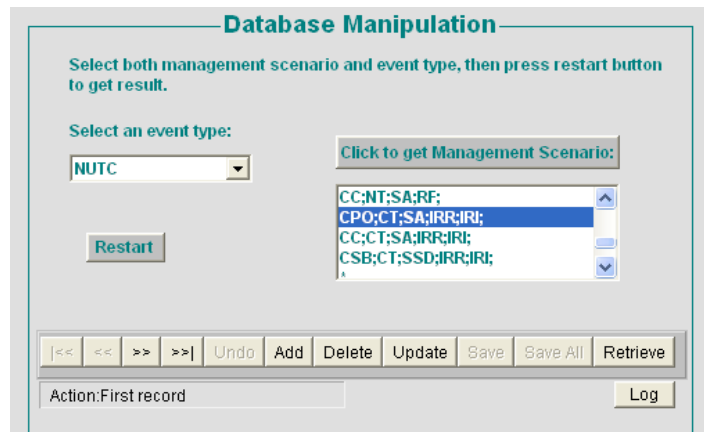
[Log](#)

Unsigned Java Applet Window

Figure 56, Event Data Entry Form

Adding Events to Your Database

A Data Event box will be displayed. This box contains a list of the first record in the database for an appropriate event type and management scenario. Additional management scenarios can be selected by clicking the *Click to Get Management Scenario* bar.



The screenshot shows a window titled "Database Manipulation". Inside, there is a text instruction: "Select both management scenario and event type, then press restart button to get result." Below this, on the left, is a section "Select an event type:" with a dropdown menu currently showing "NUTC" and a "Restart" button. On the right, there is a button labeled "Click to get Management Scenario:". Below this button is a list box containing four management scenarios: "CC;NT;SA;RF;", "CPO;CT;SA;IRR;IRI;" (which is highlighted), "CC;CT;SA;IRR;IRI;", and "CSB;CT;SSD;IRR;IRI;". At the bottom of the window is a toolbar with buttons: "<<<", "<<", ">>", ">>>", "Undo", "Add", "Delete", "Update", "Save", "Save All", and "Retrieve". Below the toolbar is a text field containing "Action:First record" and a "Log" button.

Figure 57, Database Manipulation Window

The list to the left of the Database Manipulation window displays additional event types that can be selected. The database can then be queried to get a list for the particular event types and accompanying management scenario. Select NUTC from the drop-down menu on the left as your event type, and then select CPO;CT;SA;IRR;IRI; as a management scenario for this example. NUTC stands for commercial fertilizer applications, while other event types include HARV (harvest information), NUTM (manure applications), TILL (tillage), IRR (irrigation), and PLNT (planting and crop information). Click on the Restart button in order to query the database again.

Data Entry Form

Edit Code Help

Event Data Entry Form

Print

EVENTID	99	NH4%	*
MUID	10101		0
MONTH	3		0
DAY	04		*
YEAR	2002	Method of APP>	Knifed/Injected
EVENTTYPE	NUTC	Fert.APP.(Lsb/ac)	277
Fertilizer Type	Anhydrous ammoni		
% Nitrogen	82		
NO3%	*	Mgnt.scenario	CPO;CT;SA;IRR;IRI;

Database Manipulation

Select both management scenario and event type, then press restart button to get result.

Select an event type:

NUTC

Restart

Click to get Management Scenario:

CC;NT;SSD;RF;
CC;NT;SA;RF;
CPO;CT;SA;IRR;IRI;
CC;CT;SA;IRR;IRI;
CSD;CT;SSD;IDD;IDI;

<< < > >>

Undo Add Delete Update Save Save All Retrieve

Action: Updating Row: 1 of 9 State: Modified Log

Unsigned Java Applet Window

You can print a copy of the records with the print button

For this example select NUTC

You can scroll back and forth with the forward and backward buttons. You can also add records with the add button

Click this bar to get a different management scenario. For this example select CPO;CT;SA;IRR;IRI;

Figure 58, Event Data Entry Form

Displaying Records In Your Database

The system will display the first record on the sort for this event type and management scenario. You can scroll back and forth through the records which are available. You will notice the numbers changing as you scroll back and forth to display other records. You can add another record with the add button, and there is also a capability to print a copy of your results with the print button.

Detailed Management Applet- Advanced

This applet contains both an identity entry form as well as a series of help menus. The help menu is useful if you need to fill out a new data entry record and aren't familiar with all the options for each field. The help menu displays a list of options to assist in completing the data entry form.

In order to elicit the event help menu, place your cursor on the help menu, and a drop-down list will appear. Select event code, and another list will appear. This list contains all of the possible event codes you can choose from. You will choose NUTC.

A Simple Frame

Event Code: NUTC

Fertilazer type: type of commercial fertilizer, list as follows:
Anhydrous ammonia

% Nitrogen: 82

% NO3: 0

% NH4: 0

Appl. method: method of fertilizer application, list as follows:
Knifed/Injected-Aqueous ammonia

Fert. appl.(Lbs/ac): 277

Mng. scenario: CPO;CT;SA;IRR;IRI

Help Section:

EVENTTYPE: will always be NUTC for a fertilizer application event.

Type of commercial fertilizer: must be one of these options:

- Anhydrous ammonia
- Ammonium chloride
- Ammonium polyphosphate

Back to Data entry form Help Continue Print Exit

Unsigned Java Applet Window

Figure 59, Event Code Help Section

The event code help session defines the types of commercial fertilizers that can be accepted by the program. There are thirteen types for the NUTC event code. The help session also defines the abbreviations in the event data entry form. If you choose a different event code, such as PLNT, the help menu will define the entry codes for that event, such as name of crop and yield goal.

Return to the entry data form, and fill out the form as follows:

EVENTID	98	NH4%	
MUID	10101		
MONTH	03		
DAY	06		
YEAR	2002	Method of APP.	Knifed/Injected
EVENTTYPE	NUTC	Fert.APP.(Lbs/ac)	277
Fertilizer Type	Anhydrous ammoni		
%Nitrogen	82		
NO3%		Mgnt.scenario	CPO;CT;SA;IRR;IRI;

Figure 60, Event Entry Form

Since this is not a fertilizer blend, do not type in anything in the categories for NO3% or NH4%. Press save when you have finished entering the data into the form. This record will then be added to the database. Pres restart to check if the record you entered was saved. Restart will sort through the current records and display the first record. You will need to scroll through the records in order to find the record you added. All of the newest information is part of the user database.

MUIR Soils Download Tool

This tool allows you to download soils data from the NRCS Map Unit Information Record (MUIR) database. MUIR data is a collection of soil and soil-related properties and attributes for a soil area, including its map units and component layers.

You will learn:

- *How to select State and County soil codes
- *How to process the soil entries

To begin using the MUIR soils download tool, select the *MUIR Soil Database* under the *Basic Tools* menu.



Figure 61, BasicTools menu

Database Selection

A soil database window will appear. You will select the target database for the soils data download. These are databases which will be currently set up on your account. You will then need to click on the MUIR Finder button to select a particular soil survey that you will download.

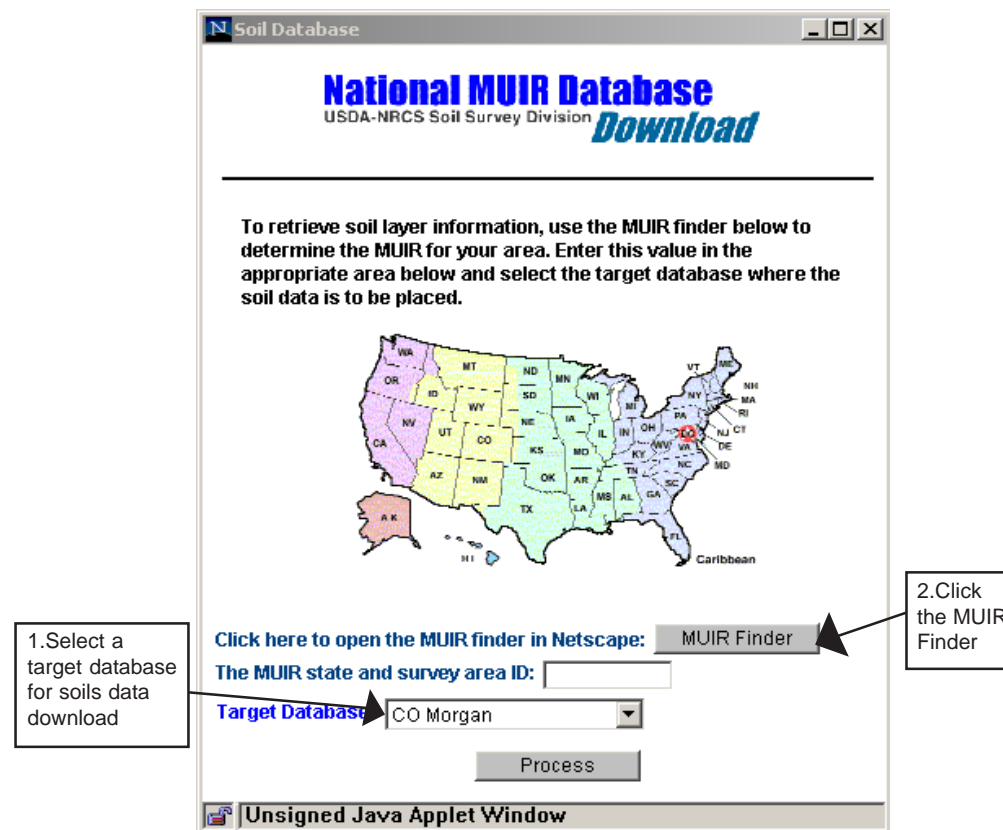
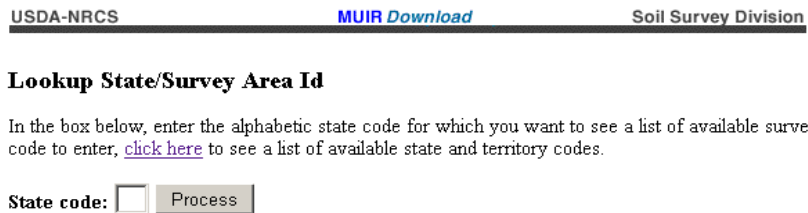


Figure 62, Soil Database

Selecting State and County Soil Codes

You will enter the abbreviation for the state you are interested in. For this example you will use CO, for Colorado.



The screenshot shows a web interface for the USDA-NRCS Soil Survey Division. At the top, there is a header bar with "USDA-NRCS" on the left, "MUIR Download" in blue text in the center, and "Soil Survey Division" on the right. Below the header, the section is titled "Lookup State/Survey Area Id". A paragraph of text instructs the user to enter an alphabetic state code and click "Process", or to click a link if unsure. At the bottom, there is a form with the label "State code:" followed by a text input box and a "Process" button.

USDA-NRCS MUIR Download Soil Survey Division

Lookup State/Survey Area Id

In the box below, enter the alphabetic state code for which you want to see a list of available survey area ids and names, then click "Process". If you are unsure of what state code to enter, [click here](#) to see a list of available state and territory codes.

State code: Process

Figure 63, State Selection Window

Click the process button, and a list of available MUIR soil surveys for the State of Colorado will appear.

USDA-NRCS

MUIR Download

Soil Survey Division

Available state and survey area ids for Colorado:

After identifying the state and survey area id for which you want to download data, return to the download page and enter it in the selection box.

Return to MUIR download page

CO001	ADAMS COUNTY AREA, PARTS OF ADAMS AND DENVER COUNTIES, COLORADO
CO005	ARAPAHOE COUNTY, COLORADO
CO009	BACA COUNTY, COLORADO
CO011	BENT COUNTY, COLORADO
CO017	CHEYENNE COUNTY, COLORADO
CO023	COSTILLA COUNTY AREA, COLORADO
CO025	CROWLEY COUNTY, COLORADO
CO061	KIOWA COUNTY, COLORADO
CO063	KIT CARSON COUNTY, COLORADO
CO073	LINCOLN COUNTY, COLORADO
CO075	LOGAN COUNTY, COLORADO
CO087	MORGAN COUNTY, COLORADO
CO089	OTERO COUNTY, COLORADO

Figure 64, County Look-up Window

Return to the main page and type in the record, CO087. Click the process button to begin the download data conversion process to the NLEAP database format. At this point, your soils data is on your user account in proper NLEAP format.



Figure 65, GIS Soil and Management Tool

GIS Soil and Management Tool

This tool allows you to associate field soils with an event selection.

You will learn:

- *How to select soils and event types
- *How to save the data for future use

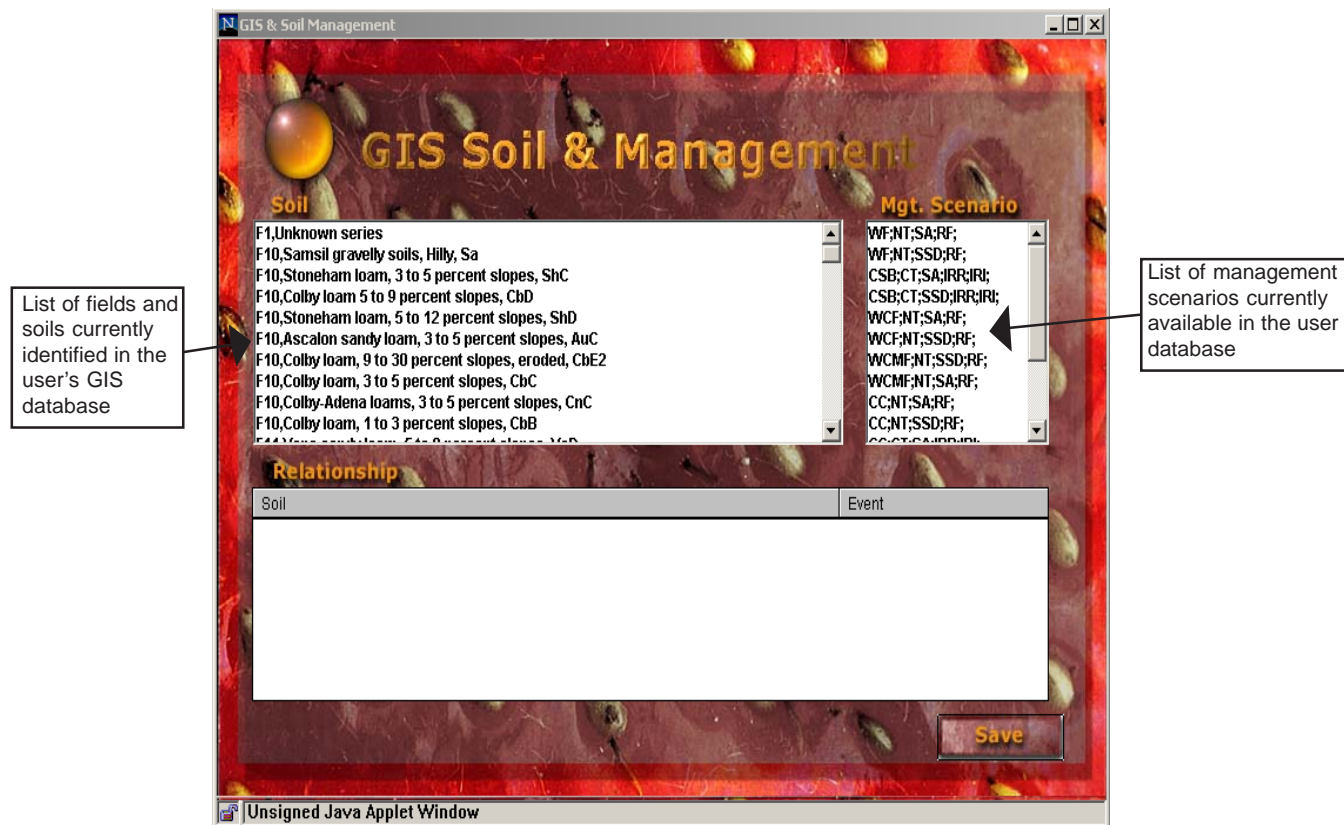


Figure 66, GIS Soil and Management Tool

Adding Soil and Management Scenario Association Records

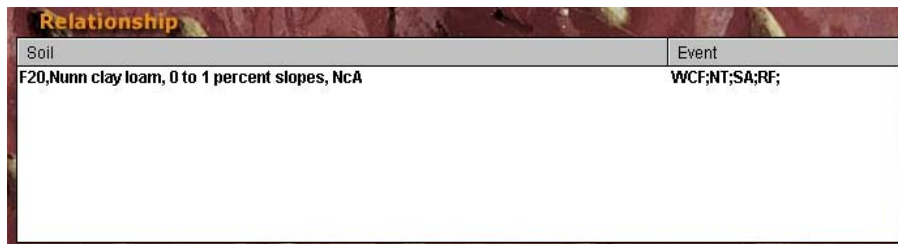
Place your cursor on GIS Soil and Management Selection in the *Basic Tools* menu and click.



Figure 67, Basic Tools menu

Soil Relations

A GIS Soil and Management box will appear. The left hand column contains a list of fields and soils currently identified in your personal-account GIS database. The right hand column contains a list of management scenarios currently available in the user database. Scroll through the list of soil selections in the left hand column and select soil F20, Nunn Clay Loam, where the F20 refers to the farm field identifier. Next, scroll through the right hand column and select the event scenario WCF;NT;SA;RF (wheat-corn-fallow rotation; no-till; single application of fertilizer; rain-fed conditions). You will notice that these records have been added to the relation box. If your records include an unknown series, do not include this in the relationship box. If you mistakenly place a record in the relationship box that should not be there, highlight it and hit the delete key.



Soil	Event
F20,Nunn clay loam, 0 to 1 percent slopes, NcA	WCF;NT;SA;RF;

Figure 68, Relation box

Saving Records

Click on the Save button. A save box will appear. Type in the appropriate file name and press the save button.

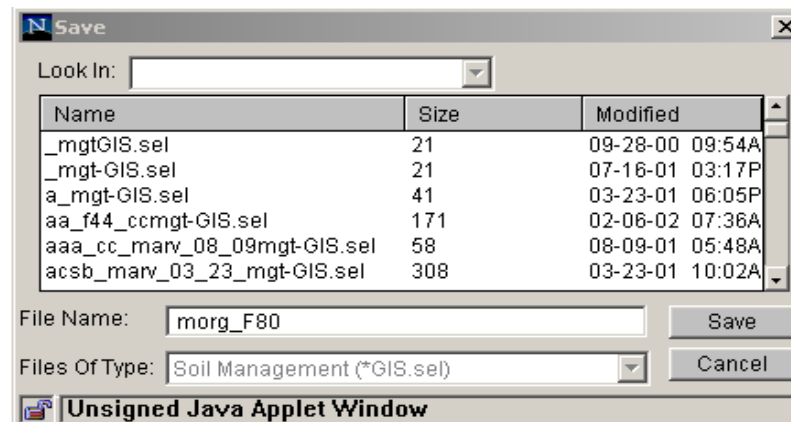


Figure 69, Save Window

This saves the information to your account for use with the simulation analysis tool. It will run each case you saved. You may save multiple cases.

Quick Management Wizard

This tool allows you to efficiently select your farm management practice scenario. This scenario is then saved to your files for future use with the NLEAP simulation tool. The Quick Management Wizard contains a series of menus that access pre-defined scenarios for combinations of local crop rotations, tillage, fertilizer applications, water source, and irrigation type. Use this tool and associated scenarios when you want to make a single NLEAP simulation for a particular soil and scenario.

To begin using the quick management wizard, place your cursor over the *Management* selection under the *Quick Analysis Wizards* menu, and click.



Figure 70, Quick Analysis Wizard

This will bring up the initial management selection window. You will select your crop rotation scheme by clicking on the proper menu item, in this case *Continuous Corn, CC*, and then by clicking the next button.

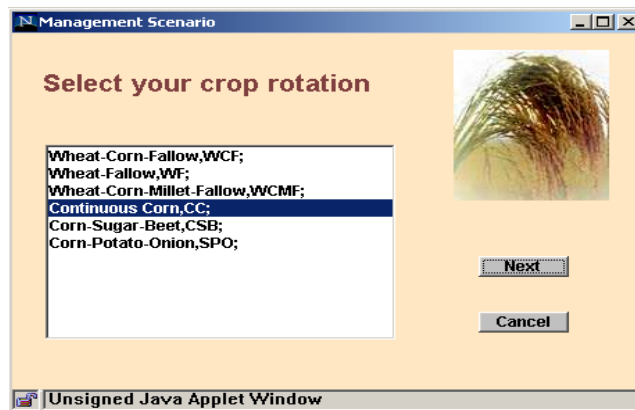


Figure 71, Crop Selection Box

You will now be prompted to select your tillage practice, which in this example is *Conventional Tillage, CT*. Click next.

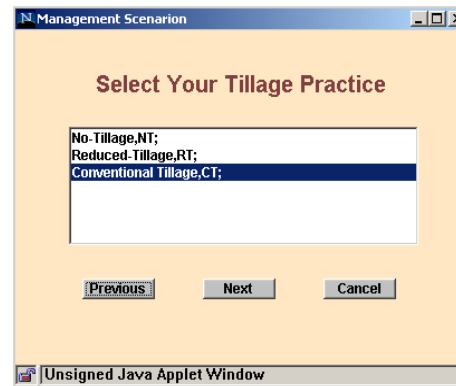


Figure 72, Tillage Practice

You will now select your fertilizer practice. Choose your fertilizer practice from the menu, in this case *Starter Side Dress, SSD*, and click the next button.



Figure 73, Fertilizer Practice

In this step you will choose a type of irrigation system used on your farm. For this example you will use *Irrigated, IRR*, and then click the next button.

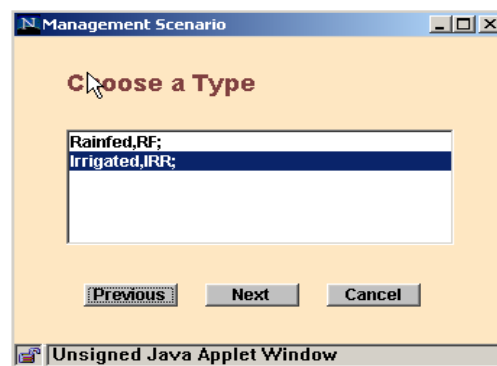


Figure 74, Irrigation Type

You will now select your irrigation practice, which in this case is *Irrigation at Regular Intervals, IRI*, and click the next button.

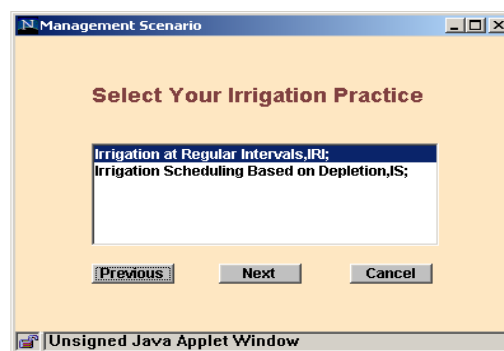


Figure 75, Irrigation Practice

This brings you a group of management scenarios which you have previously selected. Make sure they are indeed the management scheme which you chose, and click the save button.

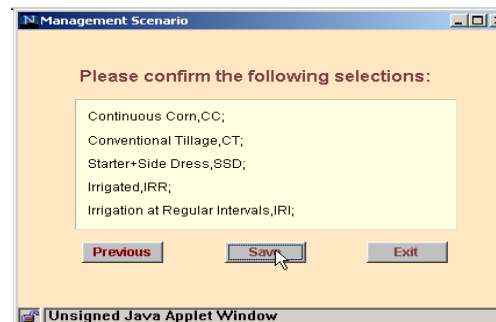


Figure 76, Confirm Selections

A Connect Dialog box will appear, followed by a Save window. When the Save window appears, you will enter an appropriate filename and press save. A new window will appear. If you would like to add more management scenarios, click yes. If not, click *no*. **Please note that management scenarios saved here are meant for later use in conjunction with soils selected in the Quick Soils Wizard to make NLEAP simulations on single sets of soil/management scenario conditions. GIS analyses involving multiple soils and management scenarios are always handled with the GIS tools. This allows users who do not have GIS coverages for their locations or do not wish to use the GIS capabilities to still complete their analyses with Internet NLEAP.**

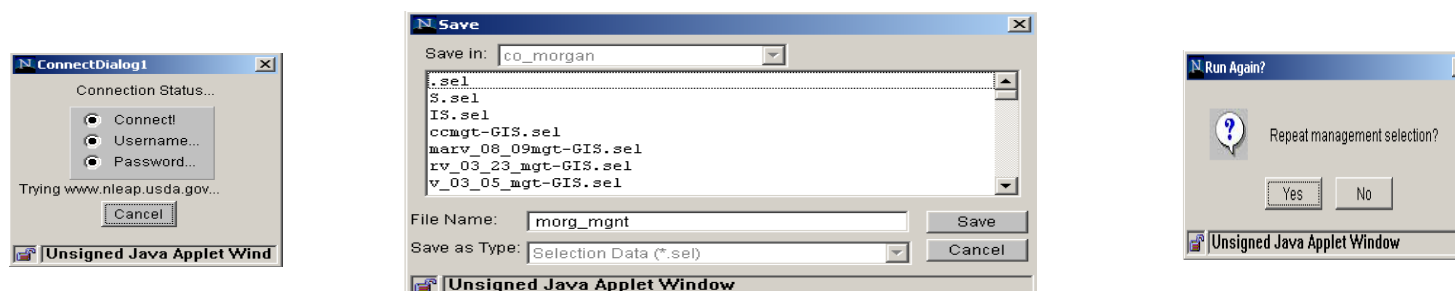


Figure 77, Steps to Add Management Scenarios

Quick Soils Wizard

You will learn:

- *How to choose a particular soil type
- *How to save your data

To begin using the quick soils wizard, place your cursor over the *Management* selection under the *Quick Analysis Wizards* menu, and click.



Figure 78, Quick Analysis Wizard

This will bring up a short list of soils which are available on your soils database for use in model simulation. **If you cannot find your soil on this list, then use the Soils Detail Wizard to make your selection.** You can select a soil that you want to use by placing your cursor over it and clicking. In this example you will use Valentine sand. Click the save button when you have finished selecting your soil type.

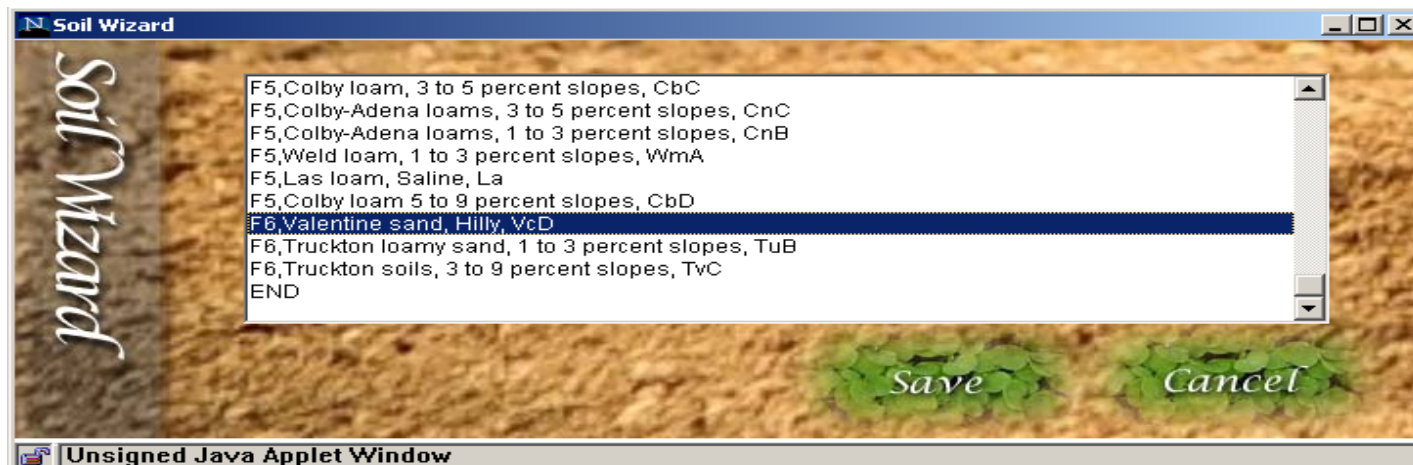


Figure 79, Soil Wizard

A save box will appear, and you will save your soils information to a system file. Press the save button, and then press the cancel button to leave the applet.

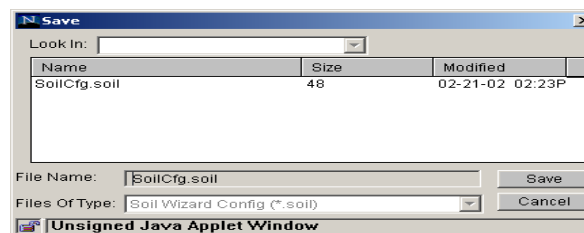


Figure 80, Save Box